DOCUMENT RESUME

ED 255 424 SO 016 310

TITLE	World Agriculture: Review and Prospects into the 1990s. A Summary.
INSTITUTION	Winrock International Livestock Research & Training Center. Morrilton, AR.
PUB DATE	Dec 83
NOTE	59p.; This report summarizes a major public policy study presented at the Annual Aspen Institute for Humanistic Studies Forum on Food, Water, and Climate (1st, Queenstown, MD, September 1983).
PUB TYPE	Reports - General (140)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Agricultural Production; Agricultural Supplies; *Agricultural Trends; Agriculture; Demography; Economic Development; Economic Factors; *Food; *Futures (of Society); *Global Approach; Government Role; Income; International Trade; Population Trends; Prediction; Public Policy; Trend Analysis
IDENTIFIERS	Food Consumption; Food Scarcity; United States

ABSTRACT

The four chapters of this analysis of world agriculture deal with production, consumption, and world trade. World food production and consumption continued to grow rapidly in the 1970's, but at a rate somewhat slower than in the 1960's. It is projected that for the 1990's consumption will increase faster than production in most of the world's regions. Global trade in food commodities expanded rapidly in the 1970's; it will continue to be an important aspect of the world food system. Overall, the world will be able to feed its much larger population in 1993 marginally better than at the end of the 1970's. However, large numbers of people will continue with only barely adequate or inadequate diets, and several projected improvements hang on economic trends that are highly vulnerable to reverses. Governments of all types commonly intervene in their food and agriculture sectors because of the fundamental importance of production and distribution of food for all stable societies. Today, food and agriculture are affected as much by macroeconomic, trade, and development policies as by policies directed specifically to food and agriculture. (RM)

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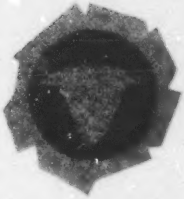
A Summary

WORLD AGRICULTURE

Review and Prospects into the 1990s

SO 016 310



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A Summary

WORLD AGRICULTURE

Review and Prospects into the 1990s

December 1983

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This summary grew out of a major public policy study conducted by Winrock International, and reported at the First Annual Aspen Institute Forum on Food, Water, and Climate, September 1983 at Wye Plantation.

Winrock International and Aspen Institute plan to continue joint sponsorship and collaboration on this annual forum to update this baseline study and to highlight study implications for major world issues, and critical geographic regions, related to food and fiber production and distribution.

PREFACE

Several times in the last 30 years, the world has experienced intense concern about both relative food scarcity and troublesome surpluses. The highly uneven distribution of food around the globe remains a persistent concern. Today, we enjoy an unusual agricultural abundance in the food-surplus regions of the world. But, the potential is perhaps greater than ever for a sudden, dramatic shift. Global food stocks provide little protection for many of the world's people, and that shield is diminishing as populations grow.

It is extremely important to monitor the global food situation closely. In particular, we must better understand the underlying trends determining the ever-precarious food balance which, as we saw in the early 1970s, can shift so quickly and dramatically.

The analysis summarized here is an activity of the Winrock International public policy program. We believe an improved understanding of all aspects of the world food system is fundamental to enlightened policies, whether for directing economic development strategies, governing commercial international trade, supporting farm product prices, or guiding food aid. Winrock International's public policy program seeks to help narrow the gaps in our understanding, especially as they relate to the role and interaction of food and agricultural policies.

This study was the subject of the First Annual Aspen Institute Forum on Food, Water, and Climate. The participants at that Forum—from academic, government, business, and private volunteer organizations—provided valuable suggestions, many of which are reflected in this summary. We acknowledge these many suggestions with thanks and extend our appreciation to Aspen Institute for sponsoring the Forum.

We envision this report as the first of a series that would annually present a review of the current global food and agriculture situation and update the decade-ahead outlook, each time incorporating new information pertinent to this vital sector of world economy.

Richard O. Wheeler
President

December 1983

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INTRODUCTION

Today's dynamic and increasingly complex world food economy is central to many of the most critical concerns of individual nations and the international community at large. Examples abound:

- A severe drought across broad areas of the African continent threatens the already-meager food supplies of large numbers of people. Averting disaster will require mobilization of massive emergency food assistance.
- Western Europe and the United States continue to escalate their confrontation over agricultural trade matters, keeping the two on the verge of an expanded trade war.
- The United States and the Soviet Union complete a new long-term trade agreement for agricultural products, an action with broad significance for the tenuous and volatile relations between the two superpowers.
- The U. S. government institutes for 1983 the largest agricultural crop production control program in history; program costs rise to unprecedented levels; and adverse weather, possibly the worst since the 1930s, immediately shifts concern from surpluses to tight supplies and high prices.
- The economic situation in many developing countries becomes more critical, especially for those dependent upon external markets for basic raw commodities and those that must import petroleum in ever greater quantities as a prerequisite for future development.
- The U.S. agribusiness community continues to ponder investment decisions and strategies as U.S. exports continue their sharp decline, and domestic agriculture retrenches.
- The Vatican, in an unusual international political effort, attempts to win broad social and political concessions from the Polish communist government by the establishment of a superfund to aid private agriculture in that country.

The global food economy is dynamic, always undergoing substantial and complex changes that will affect its characteristics and performance in the years ahead. It is unlikely to diminish in importance, but rather to remain instrumental in nutrition and health concerns, economic stability and even the political stability of much of the world.

While no one can make precise predictions about the future course of so dynamic and complex a system, it is possible to examine fundamental forces that drive the system and to develop broad outlines of how it may evolve over the next decade. Having some notion of the future world environment is important to most endeavors, whether they are constructing forward-looking national policies, developing marketing and investment strategies, or assisting in improving the lot of the world's poorest people.

Winrock International's interest derives from its role as an agricultural development institution working with farmers, businesses, and governments to improve food production around the world. These efforts by Winrock and others are carried out in this much larger context of the world

food and fiber system. Thus, the effectiveness of technical assistance, business know-how, or marketing skills depends upon an environment conducive to overall development. For example, the farmer who learns how to manage a herd of dairy goats has not improved his economic status or the food supply if there are no reliable markets for his product or if price incentives are insufficient.

This Winrock International study thus provides a context for designing and implementing its development activities. It also suggests developments in the world food economy during the next 10 years that will have broad implications for individuals, the business community, governments, development and food assistance organizations, and others.

ABOUT THIS STUDY

To make the systematic examination of the global food and agriculture system a manageable task, the countries of the world were grouped into twelve regions, primarily on the basis of geographical proximity but also on similarity of economic systems. The focus is basic foods, particularly the grains. Grains are the primary basis of human diets, consumed either directly through food grains or indirectly through livestock products. The commodity coverage encompasses grains, livestock products of meat and milk, oilseeds, fibers, and other selected crops.

The treatment of broad and long-term trends rather than year-to-year events does not incorporate the effects of weather in any particular year. Even though especially favorable or adverse weather will drive food production and consumption above or below trend in any given year, it is the trend path of these variables that is of interest here.

Also, world peace is a primary precondition for trade growth. Increasing tensions and hostilities among nations can only diminish worldwide responses to the economic trends that expand or restrict trade. This study assumes that worldwide tensions will continue, perhaps at about the current level, but that enduring regional or worldwide armed conflicts will not occur.

Because the world food system is dynamic, it is today fundamentally different from what it has been during most of the post-World War II period. While the system has continually evolved, the changes of the 1970s are believed more relevant to future changes than are those of earlier periods. The basis for most of this analysis is thus the trends of the past decade. From this, projections of trends to 1993, a decade hence, are developed.

Significant limitations exist for any study of this kind. In addition to the many data limitations and frequent lack of current information about technical relationships, there is also the overwhelming difficulty of developing a construct that can capture realistically all the interactions of the many economic, political, social, policy, and other factors that play determining roles in the world food system. The analytical approach employed here is relatively nonformal, relying heavily on qualitative assessments and judgments of the analysts. Also, the empirical projections for 1993 are not "predictions" in the conventional meaning of the word, but rather are suggested as plausible outcomes based on what is known about food system responses to certain stimuli and the specific assumptions employed.

The underlying assumptions, critical to the projected outcomes, may not be uniformly held. There can be considerable diversity of opinion about

such areas as expected future rates of population growth, rates and magnitude of economic growth, and the nature and direction of policies that will be pursued. The use of different assumptions would lead to different projected outcomes and conclusions. However, the results of this study are presented as a reasonable basis for discussion of important problems and issues that will confront governments, businesses, and individuals in the decade ahead.

This summary looks at food consumption and agricultural production and the major factors that drive them. The difference between consumption and production—the implied trade—is then analyzed. This summary closes with a review of the major findings of the study, and suggestions about their implications for the future.

REGIONS

NORTH AFRICA/MIDDLE EAST

Afghanistan
Algeria
Bahrain
Cyprus
Egypt
Iran
Iraq
Israel
Jordan
Kuwait
Lebanon
Libya
Morocco
Oman
Qatar
Saudi Arabia
Syria
Tunisia
Turkey
United Arab Emirates
Yemen Arab Republic
Yemen Democratic Republic

SUB-SAHARAN AFRICA

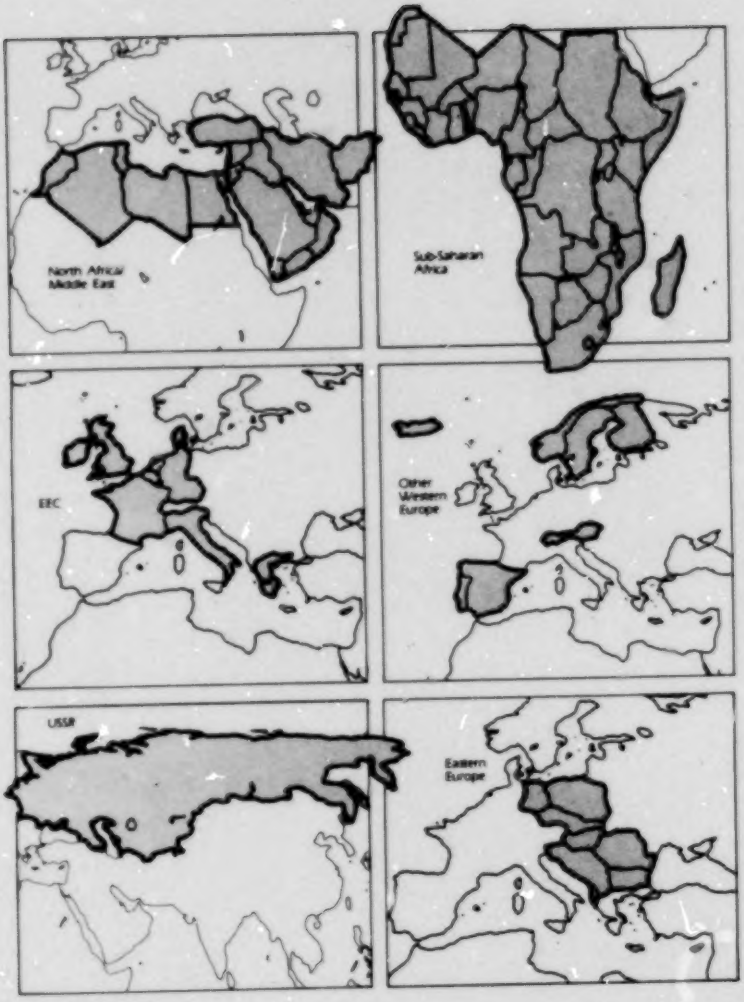
Angola
Benin
Botswana
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Congo
Equatorial Guinea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Ivory Coast
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Reunion
Rwanda
Senegal
Sierra Leone
Somalia
South Africa Republic
Sudan
Swaziland
Tanzania
Togo
Uganda
Upper Volta
Western Sahara
Zaire
Zambia
Zimbabwe

EEC

Belgium
Denmark
France
Germany
Greece
Ireland
Italy
Luxembourg
Netherlands
United Kingdom

OTHER WESTERN EUROPE

Andorra
Austria
Iceland
Liechtenstein
Portugal
San Marino



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Faeroe Islands
Finland
Gibraltar
Holy See
Malta
Monaco
Norway
Spain
Sweden
Switzerland

THE SOVIET UNION

EASTERN EUROPE

Albania
Bulgaria
Czechoslovakia
East Germany
Hungary
Poland
Romania
Yugoslavia

SOUTH ASIA

Bangladesh
Bhutan
India
Nepal
Pakistan
Sri Lanka

EAST ASIA

Brunei
Burma
East Timor
Hong Kong
Indonesia
Japan
Republic of Korea
Laos
Macau
Malaysia
Maldives
Philippines
Singapore
Thailand

ASIAN CENTRALLY PLANNED ECONOMIES

China (inc. Taiwan)
Kampuchea
Democratic People's Republic of Korea
Vietnam
Mongolia

OCEANIA

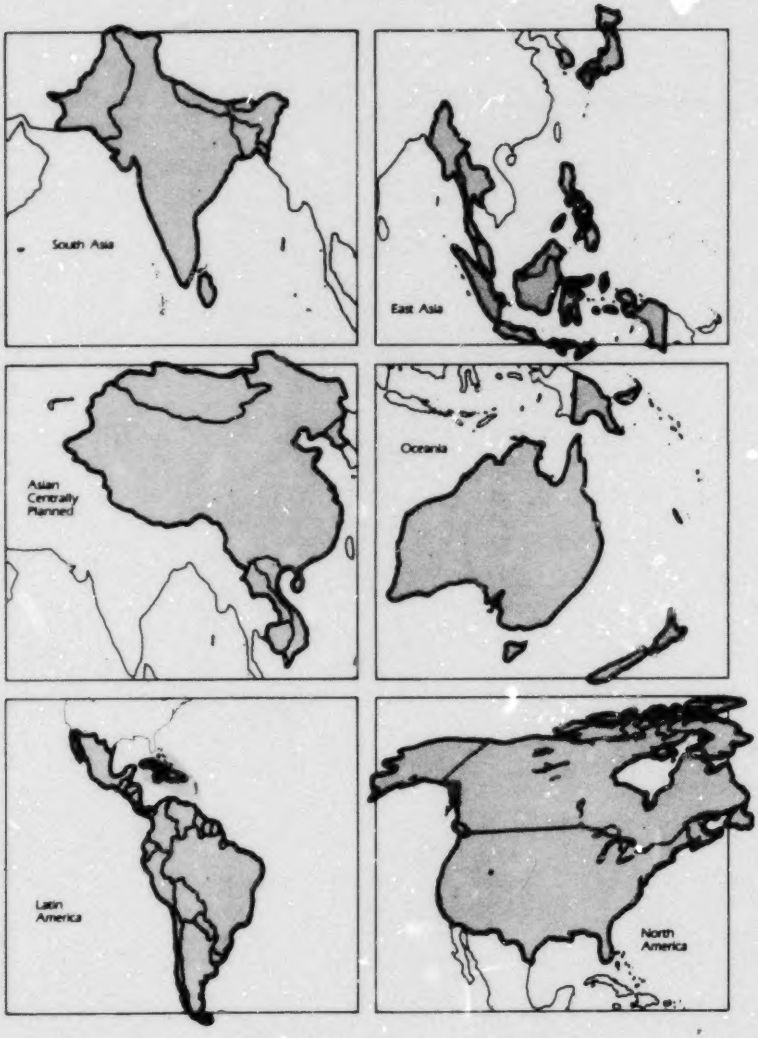
Australia
Fiji
New Zealand
Papua New Guinea

LATIN AMERICA

Antigua
Argentina
Bahamas
Barbados
Belize
Bermuda
Bolivia
Brazil
Cayman Islands
Chile
Colombia
Costa Rica
Cuba
Dominica
Dominican Republic
Ecuador
El Salvador
Falkland Islands
French Guiana
Greenland
Grenada
Guadeloupe
Guatemala
Guyana
Haiti
Honduras
Jamaica
Martinique
Montserrat
Mexico
Netherland Antilles
Nicaragua
Panama
Panama Canal Zone
Paraguay
Peru
Puerto Rico
St. Kitts
St. Lucia
St. Pierre
St. Vincent
Suriname
Trinidad/Tobago
Turks Islands
Uruguay
Venezuela
Virgin Islands (USA & U.K.)

NORTH AMERICA

Canada and United States



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CONSUMPTION

There are numerous factors that influence the demand for and consumption of food, including the level, growth, and demographics of population; and the level and growth of incomes, tastes and preferences deriving from cultures. It is assumed that the influences of these factors can be adequately captured by viewing consumption as a function of population, incomes, and policies that affect the prices and availability of food.

Population

Future consumption patterns, and the consequent requirements placed on world agriculture, will be dominated by the size and characteristics of the global population.

The global population is highly concentrated in a few regions (Figure 1). More than 85% of the world's people live in only 37 countries. The great majority of those—over three-fourths—reside in the least-developed parts of the world. This concentration will become even greater in the years ahead; 93 of every 100 people added to the global population in the next 10 years will be in those regions.

Despite the fact that the *rate* of population growth will slow slightly over the next decade, the absolute increase in population will be larger than ever before. Between 1983 and 1993, 87 million people will be added each year to the world population (Figure 2). By the year 2000, the world will have 1.8 billion more people to feed, clothe, and shelter.

The pace at which this growth is occurring varies widely among countries and regions, reflecting their different cultures, stages of demographic transition, and population policies (Figure 3). Growth is slowest in the world's six most economically developed, highest-income regions. Growth is much faster in the less-developed, lower-income regions where population pressure is already the most severe. For example, the population of Sub-Saharan Africa during the 1970s grew 8.5 times faster than did that of the European Economic Community.

In the decade ahead, four of the six developing-country regions will experience larger population increases than ever before. Absolute growth will be less only in the Asian Centrally Planned Economies and East Asia. Continued emphasis on population control will likely slow the growth rate in China enough to keep the absolute increase below that of the 1970s. In East Asia, economic growth and population-control policies will further slow the growth rate enough to hold the increase at the level of the prior decade.

The growing global population has been the principal source of growth in food consumption, and will remain so over the coming decade. From 1950 to 1982, 2 of every 3 tons of agricultural products were required just to maintain per-capita consumption—leaving only 1 of 3 to improve diets. By the 1970s, this required more than 2.4 tons and by 1993 will require even more, leaving less than .5 ton to upgrade diets and improve nutrition.

Incomes

Incomes are the other major influence on food consumption patterns. The relationship between incomes and consumption is fairly well defined. Where food consumption is already high, consumers eat very little more of

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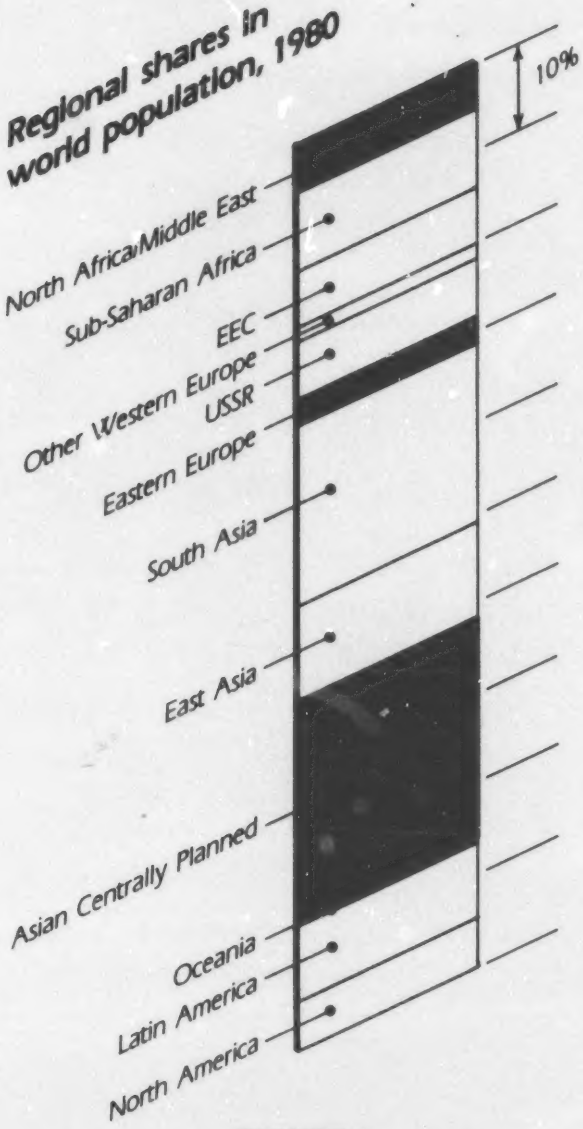
Regional shares in world population, 1980
10%
North Africa/Middle East
Sub-Saharan Africa
EEC
Other Western Europe
USSR
Eastern Europe
South Asia
East Asia
Asian Centrally Planned
Oceania
Latin America
North America

FIGURE 1

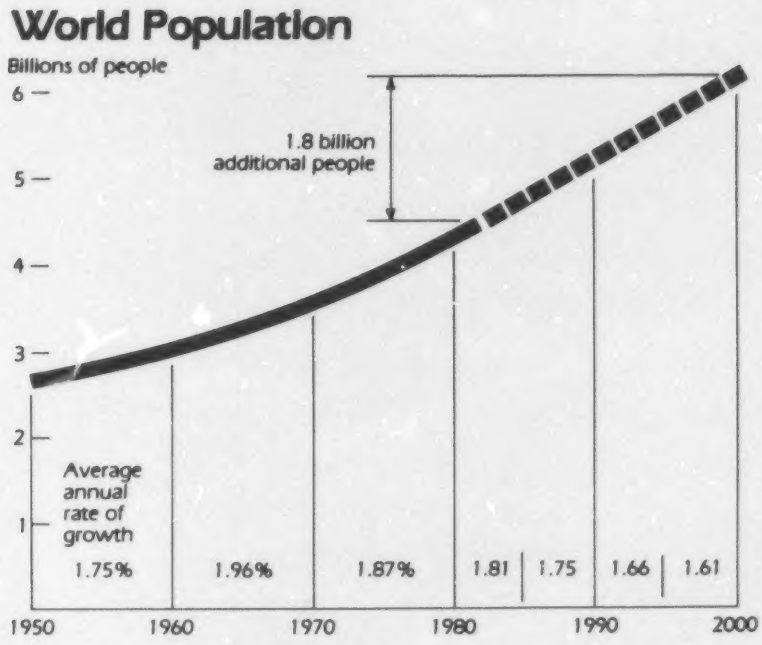
World Population
Billions of people
6
5
4
3
2
1
1.8 billion
additional people
Average
annual
rate of
growth
1.75%
1.96%
1.87%
1.81
1.75
1.66
1.61
1950
1960
1970
1980
1990
2000

FIGURE 2

POPULATION

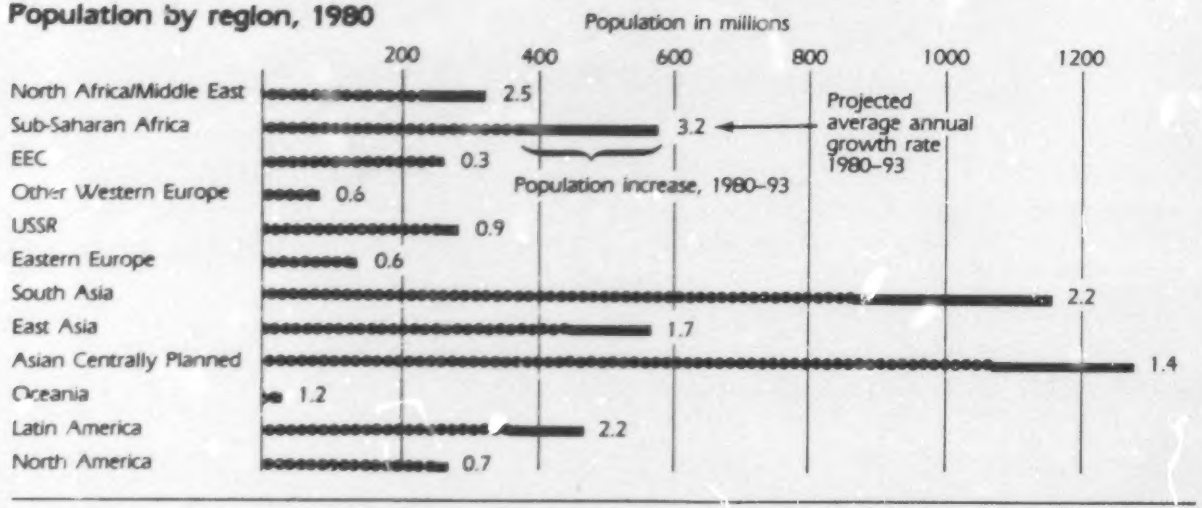

FIGURE 3

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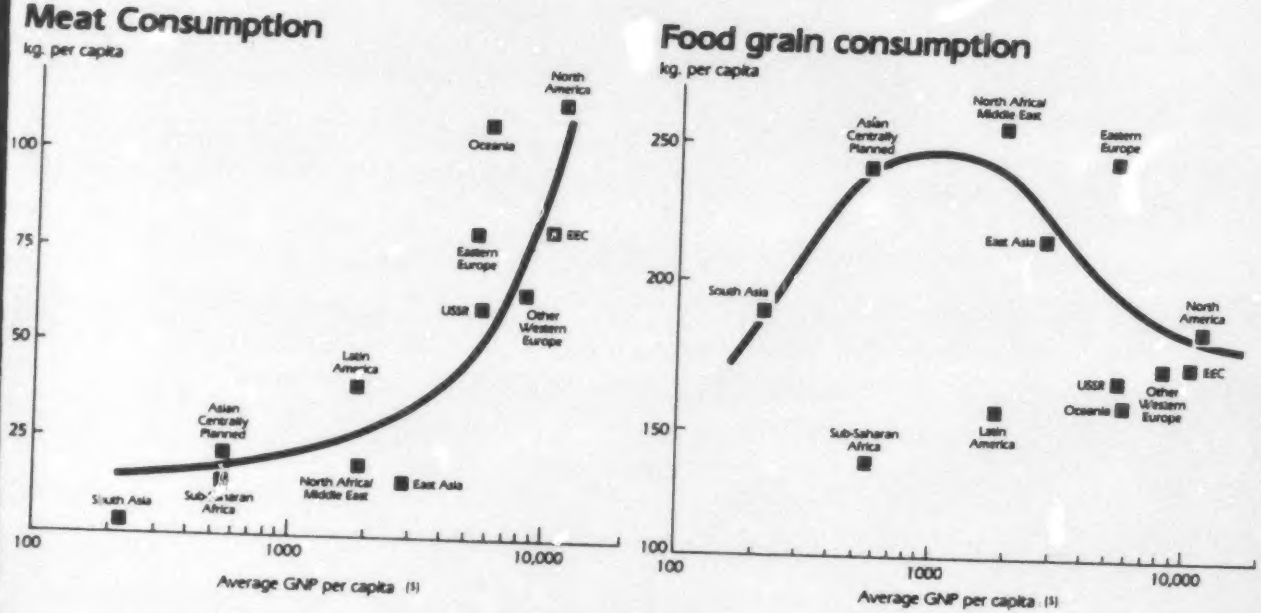

FIGURE 4

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most foods as their incomes increase. However, most of the world's people would increase consumption and improve their diets if they could. Many must struggle just to meet basic caloric needs. But, as their incomes grow, they begin to substitute meat, milk, and eggs for grain-based foods. The level and distribution of income thus help explain much of the sharply differing patterns of consumption and composition of foods among nations. The striking fact is that outside the industrialized countries, which have a small proportion of the world's people and where consumption is already high, most nations are struggling to increase economic growth, incomes, and food consumption.

As incomes increase, consumption increases very sharply, then more slowly, from initial low levels. At high consumption levels, further income growth leads to progressively smaller increases in consumption and, in the case of grains, to decreases in consumption as other foods are substituted. Calorie-short consumers use more of both grains and animal products as they are able to afford increases, but quickly begin to substitute other grains and animal products for coarse grains in order to make their diets both more nutritive and attractive (Figure 4).

In the past decade, global economic growth was erratic but generally rapid. The increase in incomes was impressive, especially in many of the developing countries where rising incomes produced a rapid growth in food demand. The world economy was jolted twice in the 1970s by sharp oil price increases, and growth was stalled in the early 1980s by the worldwide recession. Economic contraction and retrenchment began in 1981 as most industrial nations adopted monetary and fiscal policies to fight inflation. By 1983, economic measures to deal with inflation and debt have become so prominent that they can be expected to constrain investment and growth throughout the decade.

It is now becoming clear that much of the rapid growth in many developing countries was debt-financed. Efforts to curb inflation and service the debt, in combination with high interest rates and reduced investment flows from the industrialized countries, portend a period of slower growth. Although economies now are improving in much of the world, slower growth rates are projected throughout the 1980s than those in the 1970s (Figures 5 and 6). By 1993, economic growth is projected to have returned to the rate of the late 1970s, but the decade average-growth will be less than in the last decade (Table 1).

Consumption Projections

The pattern of income changes around the world will greatly influence the demand for individual commodities. The income growth of the 1970s permitted significant increases in food consumption, more rapid for meat than for grain (Figure 7). That trend is expected to continue, although more slowly than in the 1970s.

Consumption will grow faster than production in most of the world's regions, and imports must expand to permit improved levels of living. Where the divergences are greatest, real food prices can be expected to rise.

Meat

Global meat consumption is characterized by three distinct patterns. In the industrialized regions, consumption is already high and little growth

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GNP

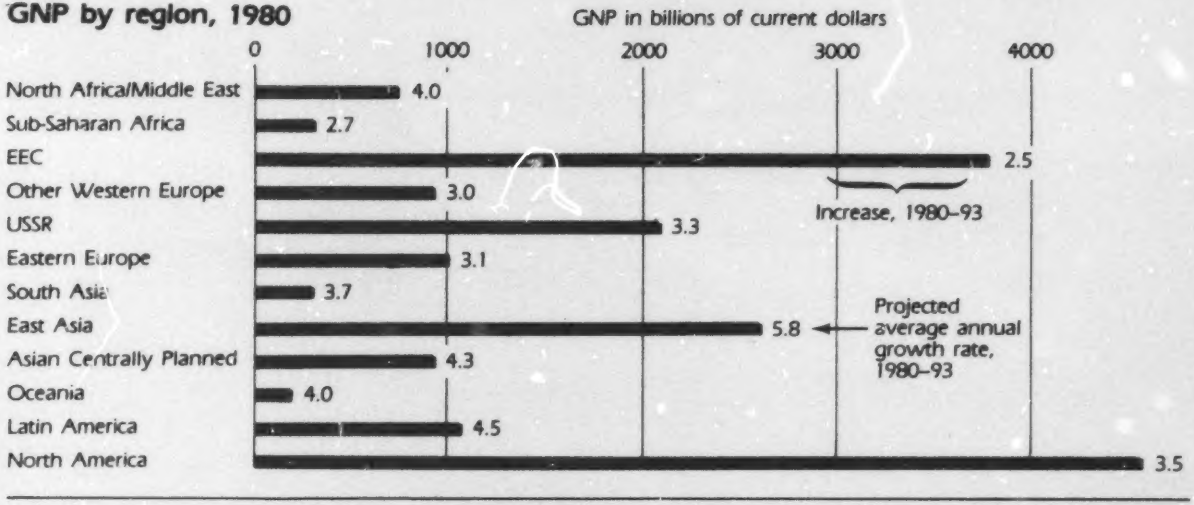
GNP by region, 1980
GNP in billions of current dollars
0
1000
2000
3000
4000
North Africa/Middle East
Sub-Saharan Africa
EEC
Other Western Europe
USSR
Eastern Europe
South Asia
East Asia
Asian Centrally Planned
Oceania
Latin America
North America
4.0
2.7
2.5
3.0
3.3
3.1
3.7
5.8
4.3
4.0
4.5
3.5
Increase, 1980–93
Projected average annual growth rate, 1980–93

FIGURE 5

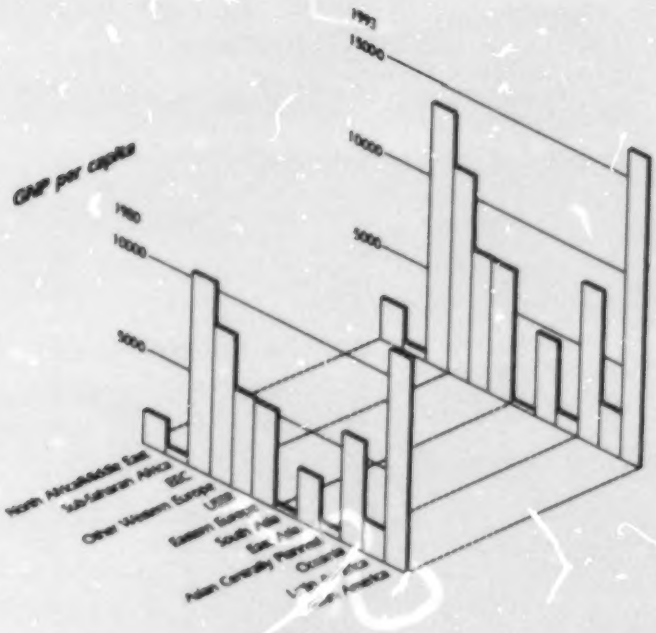

FIGURE 6

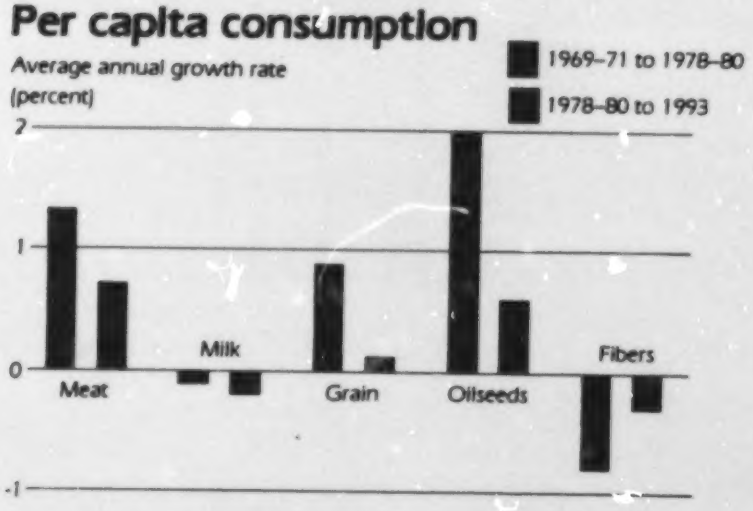

FIGURE 7

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in consumption will occur with rising incomes. In the upper-income developing nations, consumption is generally already above the world average, but growth potential is great. In the lower-income developing nations, greater consumption is severely constrained by their lack of income. It is in the latter two groups, with their large populations, where most of the consumption growth will occur over the coming decade, among other things creating greater demand for grains and oilseeds for livestock feed.

TABLE 1
Total and Per-Capita GNP Growth Rates

Region	1970-80		1980-93	
	Total	Per Capita	Total	Per Capita
	—percent—			
North Africa/Middle East	5.6	2.7	4.0	1.5
Sub-Saharan Africa	3.1	0.3	2.7	-0.5
EEC	2.9	2.5	2.5	2.2
Other Western Europe	3.3	2.5	3.0	2.5
USSR	4.8	3.9	3.3	2.5
Eastern Europe	4.6	3.9	3.1	2.5
South Asia	3.3	1.1	3.7	1.5
East Asia	7.8	5.7	5.8	4.0
Asian Centrally Planned	6.0	4.1	4.3	2.9
Oceania	4.2	2.5	4.0	2.5
Latin America	5.9	3.4	4.6	2.3
North America	3.6	2.5	3.5	2.7
World	4.3	2.4	3.6	1.9

Among the regions of the world, consumption is presently lowest in South Asia where diets have not traditionally included meat, and in Sub-Saharan Africa (Table 2). Income and population growth were about the same there during the 1970s, so there was little opportunity to improve diets with additional livestock products. Slowing population growth and sustained increases in income may imply some growth in South Asia in the decade ahead. However, in Sub-Saharan Africa population pressure and declining per-capita incomes preclude any gain. Only a further decline can be expected.

In contrast to these two regions, East Asia, with its rapid income growth, large consumption response, and moderate population growth will expand meat consumption at a rate more than five times the world average. Similarly, in North Africa/Middle East where rising incomes are sustained in large part by oil revenues, consumption also will increase rapidly.

The centrally planned economies continue to feature meat consumption prominently in their planning goals. But their expected relatively slow population growth will be offset by diminished rates of economic growth, on

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balance suggesting that the rate of meat consumption increase will be slower than in the 1970s.

Consumption in Latin America is above the world average, reflecting the very high consumption in Argentina. Most of the future growth in Latin America, however, will be in countries other than Argentina and will be the result of moderate income growth and national policies that provide strong production and consumption incentives for meats--largely pork and poultry.

Milk

Global milk consumption is highly concentrated. Consumption in Europe is several times the world average; it is similarly high in Oceania and North America. Consumption is far lower in Asia, Africa, and the ACP, the latter currently consuming only about 7% of the world average. In regions with small populations growing slowly, consumption is high; in the more densely populated regions, consumption is low.

The projected consumption pattern for dairy products (expressed in milk equivalents) is sharply different from that for meat. While significant expansion in total output is expected over the decade, it will not keep pace with population growth. The slight downward trend in per-capita consumption exhibited in the 1970s is thus expected to continue (Table 3). This results in part from the complex regulations, price supports, and trade restrictions of both developed nations and centrally planned economies that keep prices high and rising.

TABLE 2
Historical and Projected Meat Per-Capita Consumption

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—kilograms—			—percent—	
North Africa/Middle East	14.6	18.5	28.1	2.7	3.0
Sub-Saharan Africa	14.7	14.4	13.4	-0.2	-0.5
EEC	69.4	81.2	86.3	1.8	0.4
Other Western Europe	48.1	63.7	75.2	3.2	1.2
USSR	51.3	59.9	70.7	1.7	1.2
Eastern Europe	59.7	79.9	91.0	3.3	0.9
South Asia	2.1	2.2	2.8	0.8	1.6
East Asia	10.6	14.4	24.8	3.5	3.9
Asian Centrally Planned	16.6	21.2	26.9	2.8	1.7
Oceania	103.0	108.8	114.5	0.6	0.4
Latin America	34.6	38.8	48.6	1.3	1.6
North America	104.3	114.2	117.5	1.0	0.2
World	28.3	31.8	34.9	1.3	0.7

Source: Historical data from FAO.

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TABLE 3
Historical and Projected Milk Per-Capita Consumption

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—kilograms—			—percent—	
North Africa/Middle East	74.8	92.8	105.0	2.4	0.9
Sub-Saharan Africa	32.3	27.8	26.0	-1.6	-0.5
EEC	378.0	386.6	387.5	0.3	.0
Other Western Europe	269.4	278.7	289.6	0.4	0.3
USSR	333.6	363.7	371.0	1.0	0.1
Eastern Europe	299.7	337.6	360.4	1.3	0.5
South Asia	43.7	48.7	52.9	1.2	0.6
East Asia	16.2	19.9	22.8	2.3	1.0
Asian Centrally Planned	5.6	7.2	9.1	2.8	1.7
Oceania	344.1	290.4	311.0	-1.9	0.5
Latin America	94.8	102.0	117.0	0.8	1.0
North America	272.2	263.0	273.1	-0.4	0.3
World	108.0	107.1	103.6	-0.1	-0.2

Source: Historical data from FAO.

Grains

Grain remains the cornerstone of modern food systems, the direct and indirect source of the bulk of the world's food energy. By the end of the 1970s, average consumption per person had reached 361 kg, but ranged from 155 kg in Sub-Saharan Africa where most is consumed directly to 835 kg in the USSR where only 20% is consumed directly (Table 4). In most regions, grain is relatively abundant so that economic choices between grain-based foods and animal products from grain feeds are important.

Higher per-capita consumption is expected in every region except Sub-Saharan Africa, where further decline is in prospect. Consumers in about one-half of the regions will choose to eat less grain-based food, but will use substantially more grain to produce high-protein animal products. Other regions will increase both food-grain and animal-product consumption; on balance, grain consumption will increase slightly.

Three regions of the world—the USSR, East Europe, and North America—have extremely high grain consumption—more than 800 kg per capita. These regions have the highest livestock feed use; but because their current meat and grain consumption levels are high, they have only moderate potential for further growth.

Policy changes in several of the world's large grain-producing regions are having major impacts on the grain system. The Soviet decision in the early 1970s to maintain and expand meat consumption is perhaps most notable because of the subsequent impact this has had on world grain

TABLE 4
Historical and Projected Cereals Per-Capita Consumption

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—kilograms—			—percent—	
North Africa/Middle East	309.8	357.8	359.1	1.6	.0
Sub-Saharan Africa	160.9	155.0	149.6	-0.4	-0.3
EEC	441.3	457.3	464.3	0.4	0.1
Other Western Europe	416.3	537.2	614.7	2.9	1.0
USSR	672.5	835.4	912.7	2.4	0.6
Eastern Europe	651.3	816.9	879.0	2.5	0.5
South Asia	214.4	213.2	218.1	-0.1	0.2
East Asia	261.5	290.4	333.4	1.2	1.0
Asian Centrally Planned	246.8	299.6	321.4	2.2	0.5
Oceania	321.0	389.3	526.0	2.2	2.2
Latin America	234.0	261.0	280.6	1.2	0.5
North America	858.8	807.0	881.8	-0.7	0.6
World	334.7	361.1	369.1	0.8	0.2

Source: Historical data from FAO.

markets. Soviet grain imports grew rapidly. Most of the additional amount was consumed indirectly in the form of meat and other animal products. Soviet plans include further growth in meat consumption, maintaining pressure on the agriculture sector and figuring prominently in future grain-import requirements.

Eastern Europe likewise expanded meat consumption in the 1970s. That region's growth in per-capita grain consumption was one of the fastest in the world. Much of this was made possible by debt-financed imports. Future meat consumption is expected to expand much more slowly and grain use to also slow as a consequence.

The world's fastest growth in grain consumption likely will be in Oceania where only small amounts of grain are fed per unit of animal products produced, but where a relatively small increase in grain feeding will occur to support growth in its large meat and milk exports. Grain feeding will also increase in Europe at rates above the world average. The North Africa/Middle East region, while attempting to rapidly increase meat and milk consumption and production, will still depend heavily on meat imports, so that the growth in grain consumption there likely will be slower than the world average.

Oilseeds

The oilseed consumption growth of the 1970s was based on rising demand for both oil and high-protein meal for animal feed, but was most directly driven by the demand for livestock products. This trend can be expected to continue through 1993, but at a diminished rate.

Per-capita consumption is greatest in North America, followed by the EEC and Eastern Europe where livestock-product consumption is large and the use of high-protein animal feeds is highest (Table 5). These regions are projected to continue this high use through the decade. North America and the European regions (except the USSR) will consume 100 kg or more per capita by 1993.

In the less-developed regions, meat consumption and oilseed use are generally lower, but will expand most rapidly in the future. While per-capita consumption will likely decrease in Sub-Saharan Africa and South Asia, consumption will increase very rapidly in both East Asia and the ACP.

TABLE 5
Historical and Projected Oilseeds Per-Capita Consumption

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—kilograms—			—percent—	
North Africa/Middle East	17.6	20.5	23.9	1.7	1.1
Sub-Saharan Africa	16.4	14.1	12.4	-1.6	-1.0
EEC	70.1	120.2	137.9	6.2	1.0
Other Western Europe	43.0	77.7	100.1	6.8	1.8
USSR	49.2	45.4	58.9	-0.9	1.9
Eastern Europe	44.7	80.6	99.8	6.8	1.5
South Asia	14.7	13.1	12.6	-1.2	-0.3
East Asia	15.2	20.2	28.3	3.2	2.5
Asian Centrally Planned	18.4	19.1	23.2	0.4	1.4
Oceania	9.7	18.9	60.4	7.7	8.6
Latin America	21.5	25.3	31.1	1.8	1.5
North America	103.0	132.8	148.3	2.9	0.8
World	29.7	35.5	38.5	2.0	0.6

Source: Historical data from FAO.

Fibers

Competition from manmade fibers slowed natural-fibers consumption in the 1970s. The pattern of use was characterized by per-capita declines in most developed regions and only slight increases in some of the others. Worldwide, per-capita consumption trended downward by 0.7% annually. The consumption of cotton, the most important of the natural fibers,

declined in the industrial countries as a result of rapid growth of synthetics but increased in developing and centrally-planned economies.

The downward trend in per-capita consumption is expected to persist in the decade ahead. However, the decline should be slower as the competition from synthetics is less intense. Cotton use is projected to increase during the next decade, enough that per-capita consumption grows slightly. However, the outlook for wool and other fibers is less promising, with declines in per-capita consumption predicted.

The most rapid growth likely will be in the ACP region, with slower growth in East Asia and North Africa/Middle East (Table 6). Declines are expected in all other regions except the USSR, where per-capita consumption is expected to remain essentially unchanged. Globally, the growth in total natural-fiber consumption will not keep pace with population growth. A further small decline in per-capita consumption, from 5 kg in 1978-80 to 4.9 kg in 1993, thus is projected.

TABLE 6
Historical and Projected Fibers Per-Capita Consumption

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—kilograms—			—percent—	
North Africa/Middle East	4.0	4.3	4.5	0.8	0.3
Sub-Saharan Africa	1.5	1.3	1.1	-1.6	-1.1
EEC	7.2	4.7	4.2	-4.6	-0.8
Other Western Europe	6.6	5.3	4.9	-2.3	-0.7
USSR	11.1	10.8	10.9	-0.3	.0
Eastern Europe	7.9	8.4	8.2	0.6	-0.2
South Asia	5.7	5.3	4.9	-0.8	-0.7
East Asia	4.7	5.1	5.3	0.8	0.3
Asian Centrally Planned	3.5	4.4	5.0	2.7	0.8
Oceania	37.0	25.5	17.8	-4.1	-2.5
Latin America	3.7	3.8	3.6	0.2	-0.4
North America	7.8	5.1	5.0	-4.7	-0.2
World	5.3	5.0	4.9	-0.7	-0.3

Source: Historical data from FAO.

PRODUCTION

While the most dramatic characteristics of the world food system during the last decade were the extreme shifts from chronic grain surpluses to temporary shortages and the accompanying volatile prices, perhaps the most important trend was the worldwide increase in productivity. Food production grew faster than population, and the world was better fed and clothed by the decade's end. This was achieved with only slowly expanding land use but with technological developments that brought greater yields from the land resource (Figure 8).

Land

The expanding population means that each hectare of agricultural land must support more people each year.[1] In 1970, there were 82 people for each 100 hectares; today there are 102, and by 1993 there will be 112. Behind these global averages, the concentration of people on the land base varies widely among the regions. For example, there are only 5 people per 100 hectares in Oceania while there are more than 500 in East Asia. When only the land used to grow crops is considered, the ratios are much higher—ranging from 50 people per 100 hectares in Oceania to nearly 1,000 in the ACP. The pressure on the cropland resource is severe in some countries, especially in the ACP and East and South Asia.

The global land mass, when classified according to use, is roughly divided into thirds: about 35% is used to produce agricultural products, 31% to produce wood and timber, and 34% in all other uses (Figure 9). The proportions are not constant because there is shifting from one category to another from year to year. Two-thirds of the agricultural land is used to support animal agriculture, 30% to produce annual crops, and only 2% to produce multi-year crops. There were net increases in agricultural and other land during the 1970s, and a net decrease in forest and woodland. By 1993, 4.61 billion hectares are projected to be in agricultural uses, 38 million (0.8%) more than in 1980 (Table 7). Forest and woodland will continue to be shifted to more profitable uses, and the "other land" category will continue to increase with urbanization and desertification.

The three largest regions—Sub-Saharan Africa, Latin America and the USSR—contain almost one-half of the agricultural land, while the three European regions have less than 4% (Figure 10). About 80% of the agricultural land is found in six regions; one-third is found in Latin America and Sub-Saharan Africa alone.

Latin America (especially Brazil) and Sub-Saharan Africa were the source of most of the net increase in agricultural land in the 1970s. But there were increases in all the developing regions except the ACP. Oceania was the only developed region in which there was a net increase.

Seventy-five percent of the arable land is concentrated among six regions. Two of these regions alone—North America and the USSR—have more than one-third of the world's arable land. The changes among regions

[1] The earth's land area of 13.1 billion hectares is classified into five categories according to use: annual crops (arable), permanent crops, permanent meadows and pastures, forests and woodland, and other. The first three categories combined constitute agricultural land.

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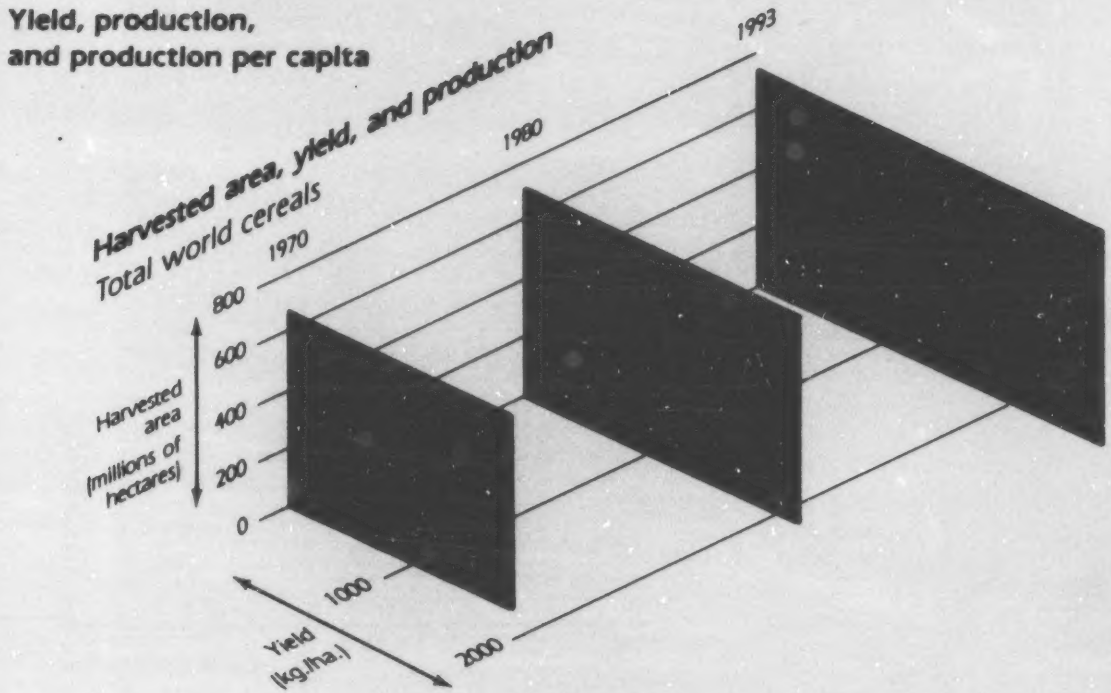

FIGURE 8 (cont.)

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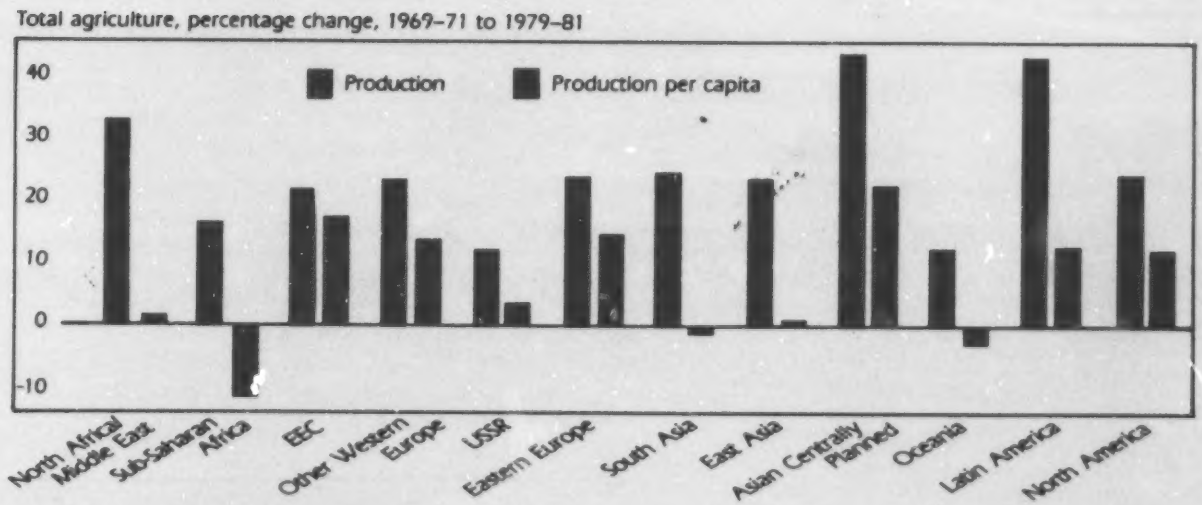

FIGURE 8

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Global land area by use

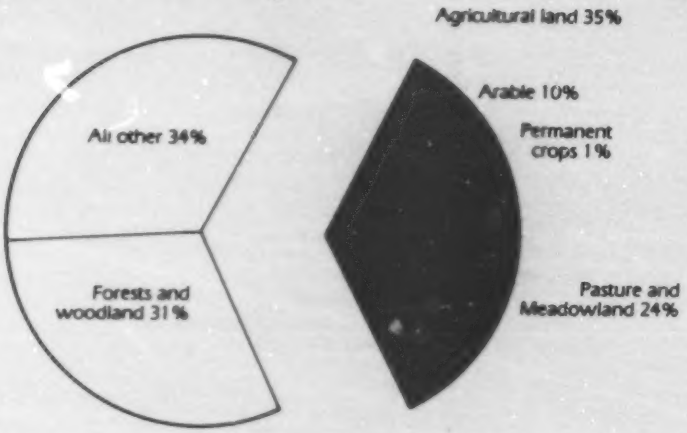
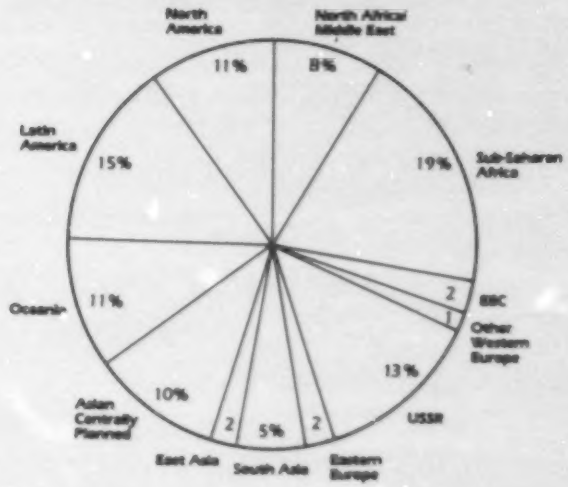


FIGURE 9

Global agricultural land base by region, 1980



1980 4,569 Million ha.
1993 4,607 Million ha.

FIGURE 10

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TABLE 7
Historical and Projected Agricultural Land Area

Region	1969-71	1979-81	1993	Annual Average Change	
				1969-71 to 1979-81	1979-81 to 1993
	—million hectares—			—percent—	
North Africa/Middle East	375.8	379.1	382.7	0.1	0.1
Sub-Saharan Africa	867.6	876.2	883.8	0.1	0.1
EEC	105.6	101.4	98.5	-0.4	-0.2
Other Western Europe	52.5	50.8	49.2	-0.3	-0.3
USSR	607.4	605.7	604.8	.0	.0
Eastern Europe	76.6	75.4	75.9	-0.2	0.1
South Asia	218.2	223.2	226.2	0.2	0.1
East Asia	79.7	85.1	90.9	0.7	0.5
Asian Centrally Planned	464.3	460.6	458.0	-0.1	.0
Oceania	508.9	512.5	516.5	0.1	0.1
Latin America	669.9	702.5	725.8	0.5	0.3
North America	498.8	496.4	494.5	-0.1	.0
World	4,525.4	4,568.9	4,606.8	0.1	0.1

Source: Historical data from FAO.

follow the same pattern as for agricultural land. The developed regions, except Oceania, show a gradual decline in land used for annual crops, while the others, except the ACP and especially Latin America, continue to increase arable area. This pattern is expected to prevail in the future.

The intensity of use of arable land is highest in the ACP where most multiple cropping occurs, and lowest in Oceania (Figure 11 and Table 8). The intensity of use has been increasing in all regions except North Africa/Middle East and Eastern Europe, and will become more pronounced as harvested area expands faster than arable area in most regions. The harvested area is projected to increase 4.6 million hectares annually, compared with 8.1 million annually during the 1970s, while arable area will increase only 2.1 million.

The world's permanent pastureland is also highly concentrated; two-thirds in just four regions, while five regions have only 4%. The area in meadows and pasture declined in most regions during the 1970s; but increases in Brazil, Australia, New Zealand, Canada, Nigeria, and Syria alone were more than enough to offset this, and the total for the world increased. In the decade ahead, however, a significant decrease is projected: a modest increase in Oceania more than offset by a sharp decline in Latin America, with little change in all other regions.

Yields

While the world's arable land base has expanded only slowly, it has become significantly more productive. Productivity gains made possible

TABLE 8
Historical and Projected Harvested/Arable Area Ratio

Region	1969-71	1979-81	1993
	—percent—		
North Africa/Middle East	57.6	57.2	57.9
Sub-Saharan Africa	73.1	74.4	76.0
EEC	71.6	73.8	75.5
Other Western Europe	64.5	67.0	69.5
USSR	63.2	65.7	66.8
Eastern Europe	80.7	77.9	78.0
South Asia	94.6	96.0	98.8
East Asia	91.6	95.6	104.9
Asian Centrally Planned	127.2	134.2	138.4
Oceania	30.5	39.5	49.0
Latin America	67.3	72.9	75.0
North America	46.2	57.7	61.5
World	72.3	76.5	79.3

Source: Historical data from FAO.

most of the greater agricultural production of the 1970s. The 2.6% average annual growth in grain production, for example, came from 1.94% yield increases and area increases of only 0.65%. Thus, three-fourths of the growth was from higher yields, the result of earlier investments in agricultural research and development. Comparison of yields between the developed and developing regions reveals a wide disparity, suggesting a large potential for greater food production through yield improvements in the developing regions (Figure 12).

Much of the yield improvement came from the "green revolution" technology of improved crop varieties and cultural practices. Another source was improvement in the land base through irrigation. Almost one-half of the world's irrigated agriculture is found in only two regions—South Asia and the ACP (Table 9). While every region irrigated a larger area in 1980 than 10 years earlier, the increase was greatest by far in South Asia, the ACP, and the USSR. The most rapid rate of expansion occurred in Eastern Europe and the USSR. The area irrigated is projected to increase in every region over the coming decade.

Much of the improvement in yields was also related to greater use of production inputs. Although fertilizer use per arable hectare in developing countries remains much lower than in the industrial regions, it rose very rapidly during the 1970s. The industrial countries in 1970 consumed 5.5 times more fertilizer per hectare than did the low-income economies. But by 1980, that ratio had fallen to only 2.2. The remaining differential in input use is an indication of the potential for productivity gains in developing regions.

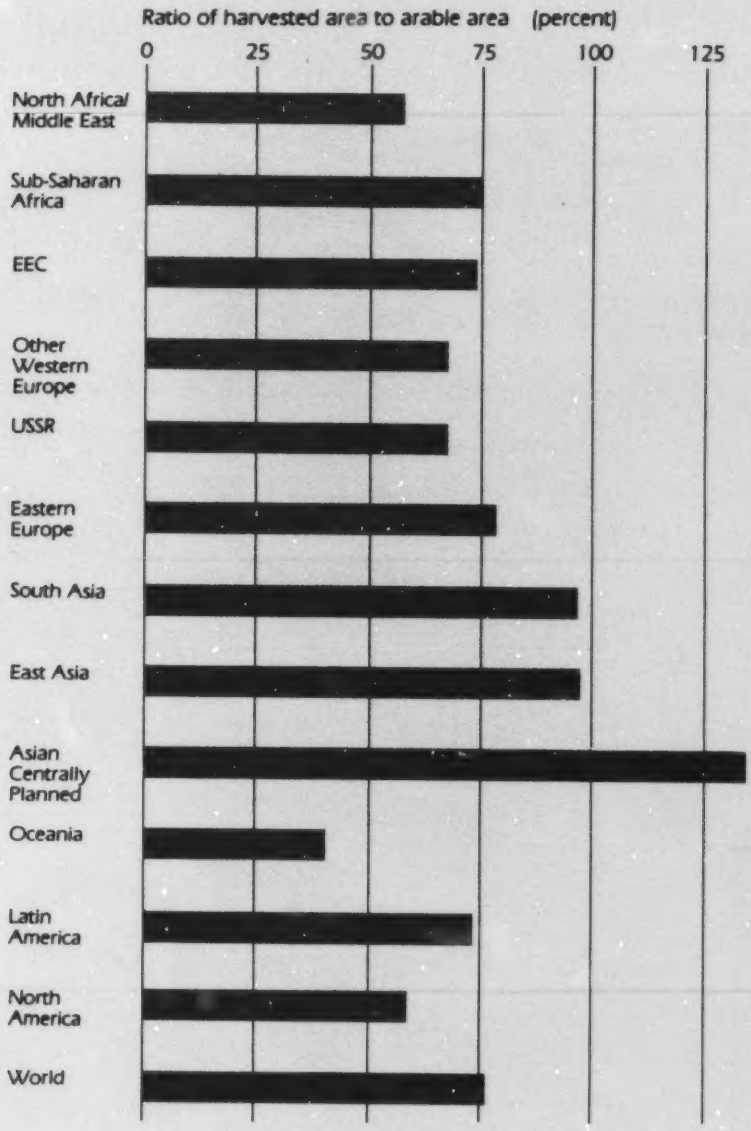
Intensity of arable land use, 1980
Ratio of harvested area to arable area (percent)
0
25
50
75
100
125
North Africa/ Middle East
Sub-Saharan Africa
EEC
Other Western Europe
USSR
Eastern Europe
South Asia
East Asia
Asian Centrally Planned
Oceania
Latin America
North America
World

FIGURE 11

FIGURE 12

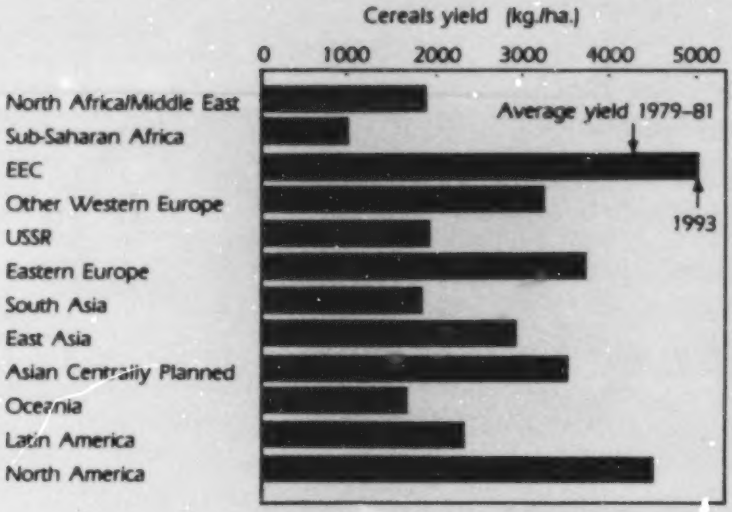

TABLE 9
Historical and Projected Irrigated Area

Region	1969-71	1979-81	1993	Annual Average Change 1969-71 to 1979-81	Annual Average Change 1979-81 to 1993
	—million hectares—			—percent—	
North Africa/Middle East	16.0	18.2	20.5	1.3	0.9
Sub-Saharan Africa	3.4	4.4	5.0	2.6	1.0
EEC	4.7	6.0	8.5	2.5	2.7
Other Western Europe	3.2	3.8	4.5	1.7	1.3
USSR	11.0	17.5	24.0	4.8	2.5
Eastern Europe	2.8	4.7	6.0	5.3	1.9
South Asia	44.7	56.0	69.0	2.3	1.6
East Asia	12.6	15.3	16.9	2.0	0.8
Asian Centrally Planned	42.6	48.9	55.4	1.4	1.0
Oceania	1.6	1.7	1.8	0.6	0.4
Latin America	10.2	14.2	18.1	3.4	1.9
North America	16.4	21.0	26.2	2.5	1.7
World	169.3	211.7	255.9	2.3	1.5

Source: Historical data from FAO.

Production Projections

The agricultural production patterns prevailing in the 1970s varied widely across commodities and regions. The rate of production expansion has thus far exceeded the population growth for most countries, but the difference narrows each year. Without exception, the developed countries increased per-capita production sharply as production outpaced the relatively slow population growth. Production also grew rapidly in the developing countries, and most improved their food balance. However, several countries have been unable to increase production or curb population growth enough to bring about a balance. In Sub-Saharan Africa, for example, rapid population growth overwhelmed production increases.

The growth in output was heavily influenced in most regions by policies and will continue to be so in the future. A striking example is the EEC where the very rapid 2.4% annual increase in cereal yields came largely in response to high internal prices. A contrast is the USSR where yields actually declined, in part due to weather but also due to the planning and incentive structures and allocation policies governing agricultural inputs.

Slowing population growth rates suggest that North America and the three European regions will be able to increase per-capita production with greater ease over the coming decade. Per-capita gains also are likely in the ACP, and possible in the USSR and East Asia, especially given the population growth-rate declines and production increases in Japan.

Oceania will be able to realize an increase if world market expansion provides the incentive. South Asia should achieve a modest increase. Latin America will be hard pressed to match the increase of the 1970s even with a modest decline in the population growth rate. North Africa/Middle East will have difficulty expanding, while a further decline in Sub-Saharan Africa is in prospect. Overall, per-capita agricultural production rose only 4% in the 1970s. An increase of the same order of magnitude is expected over the next decade.

Meat

The relatively rapid increases in income and demand for improved diets during the 1970s led to dramatic increases in livestock production worldwide. East Asia had the most rapid increase, 5.4% annually, followed by the ACP with 4.7% (Table 10). North America, which accounts for nearly 20% of global production, had the slowest rate of increase.

World meat production is becoming much more dependent on feed grains and protein rations. Production efficiency is also increasing as less beef and more feed-efficient poultry is produced.

Milk

Milk production is heavily concentrated in Europe and North America, with the EEC, USSR, and North America accounting for 58% of production (Table 11). Milk production has grown much more slowly than meat production since regions with the bulk of the world's people have invested relatively little in expanded production. Only moderate growth is projected through the decade, with slow increases in Europe and North America and somewhat faster growth in the developing countries where production per capita is by far the lowest.

TABLE 10
Historical and Projected Meat Production

Region	1969-71	1979-81	1993	Annual Average Change 1969-71 to 1979-81	Annual Average Change 1979-81 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	2.6	3.8	6.9	4.1	4.6
Sub-Saharan Africa	4.4	5.5	7.8	2.4	2.6
EEC	17.0	22.1	24.8	2.7	0.9
Other Western Europe	3.4	5.1	6.2	4.2	1.6
USSR	12.4	15.3	20.7	2.1	2.3
Eastern Europe	7.6	11.3	14.3	4.0	1.8
South Asia	1.5	2.0	3.3	3.2	3.9
East Asia	3.6	6.1	13.0	5.4	6.0
Asian Centrally Planned	14.9	23.5	34.9	4.7	3.1
Oceania	3.1	4.0	6.3	2.5	3.6
Latin America	10.5	14.3	22.3	3.1	3.5
North America	23.3	26.9	32.5	1.5	1.5
World	104.2	140.0	192.9	3.0	2.5

TABLE 11
Historical and Projected Milk Production

Region	1969-71	1979-81	1993	Annual Average Change 1969-71 to 1979-81	Annual Average Change 1979-81 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	11.7	16.3	25.1	3.3	3.4
Sub-Saharan Africa	9.2	9.7	14.2	0.6	2.9
EEC	95.2	113.7	123.0	1.8	0.6
Other Western Europe	20.5	23.3	25.7	1.3	0.7
USSR	82.5	92.9	107.7	1.2	1.1
Eastern Europe	36.7	44.8	52.9	2.0	1.3
South Asia	30.6	42.5	60.6	3.3	2.8
East Asia	5.0	7.3	10.5	3.8	2.8
Asian Centrally Planned	5.0	7.9	11.2	4.7	2.7
Oceania	13.8	12.2	15.6	-1.2	1.9
Latin America	25.4	34.1	51.2	3.0	3.2
North America	61.4	66.1	74.4	0.7	0.9
World	397.0	470.8	572.2	1.7	1.5

Source for both Tables: Historical data from FAO.

Grains

The world's fastest growth in cereal production in the 1970s came in Oceania, ACP, and North America (Table 12). In Oceania, production increases came mostly from additional area; in ACP, almost entirely from yield increases; and in North America, equally from area and yield. These three regions, with their rapid production growth, accounted for 55% of the world increase.

Relatively rapid rates of production growth are projected for Western Europe, the USSR, North Africa/Middle East, and Latin America—all regions that import grain and that are expected to maintain high real production incentives. In the traditional exporting regions of North America, Oceania, and EEC, growth rates will be lower than in the 1970s; but because their population and demand growths are slow, their export availability will continue to increase.

The outlook for grain production globally depends significantly on whether the USSR can reverse its yield trends. In the 1970s, Soviet production increased slightly, only because additional area was devoted to cereals. The expectation for 1993 is that by means of higher incentives, better planning, and the allocation of more machinery, fertilizer and pesticide inputs to cereals, productivity will increase significantly. The process will be assisted by concentration on improving the management of the area already devoted to cereal production.

TABLE 12
Historical and Projected Cereals Production

Region	1969-71	1979-81	1993	Annual Average Change	
				1969-71 to 1979-81	1979-81 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	48.6	59.8	80.7	2.1	2.3
Sub-Saharan Africa	45.7	56.3	69.8	2.1	1.7
EEC	97.7	122.7	142.3	2.3	1.1
Other Western Europe	26.0	30.4	41.2	1.6	2.4
USSR	169.3	175.0	234.6	0.3	2.3
Eastern Europe	75.3	94.6	109.7	2.3	1.1
South Asia	144.6	182.7	241.0	2.4	2.2
East Asia	80.5	104.0	144.1	2.6	2.5
Asian Centrally Planned	215.2	308.1	379.9	3.7	1.6
Oceania	14.8	21.9	36.4	4.0	4.0
Latin America	69.5	92.7	125.5	2.9	2.4
North America	244.4	344.6	433.2	3.5	1.8
World	1,231.7	1,592.7	2,038.5	2.6	1.9

Source: Historical data from FAO.

TABLE 13
Historical and Projected Oilseeds Production

Region	1969-71	1979-81	1993	Annual Average Change	
				1969-71 to 1979-81	1979-81 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	3.1	3.5	4.2	1.3	1.4
Sub-Saharan Africa	8.0	7.2	6.8	-1.0	-0.4
EEC	1.2	2.4	3.5	6.9	3.1
Other Western Europe	0.5	1.0	1.7	7.0	3.9
USSR	11.4	11.9	17.4	0.5	2.9
Eastern Europe	2.8	4.0	6.3	3.5	3.6
South Asia	12.5	13.9	16.8	1.0	1.5
East Asia	2.5	3.2	4.8	2.5	3.1
Asian Centrally Planned	16.4	21.1	30.9	2.5	3.0
Oceania	0.2	0.5	0.7	10.0	2.4
Latin America	9.0	26.1	33.2	11.3	1.9
North America	39.9	68.6	86.2	5.6	1.8
World	107.5	163.4	212.5	4.3	2.0

Source: Historical data from FAO.

Oilseeds

The oilseed area expanded dramatically during the 1970s—most sharply in Western Europe, Oceania, and Latin and North America (Table 13). In the five regions where growth was most rapid, most of the increase came from area expansion. Yield increases, while significant, were relatively small. The most rapid production increase was in Latin America, where the area was expanded more than 60%. Growth in other regions was more evenly balanced between area and yields.

A substantial 38% increase in consumption is expected for the coming decade, but the production base is sufficiently larger so that the demand can be met with lower production growth rates. The most rapid growth likely will be in the importing regions. The European and Asian regions will increase production most quickly, largely to meet internal needs. Production increases in Latin and North America will be geared to meeting increasing world export demand and both will increase production substantially over, although more slowly than in, the 1970s.

Fibers

World fiber production is dominated by five regions—the USSR, South Asia, ACP, and Latin and North America (Table 14). During the 1970s, production grew in these regions but was stable or declining in all others.

Because natural fibers are expected to be more competitive with synthetics during the coming decade, more rapid increases in production are expected—again with much of the increase occurring in ACP and South Asia.

The growth in production during the next decade will be greatest in the already-dominant regions. But five of the twelve regions will increase production more than 1.5% annually, with no change in Oceania or Other Western Europe, and a decline in Sub-Saharan Africa. An average increase of 0.8% can be expected in North America, in contrast to the more rapid growth of the 1970s.

TABLE 14
Historical and Projected Fibers Production

Region	1969-71	1979-81	1993	Annual Average Change 1969-71 to 1979-81	Annual Average Change 1979-81 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	1.5	1.5	2.1	.0	2.7
Sub-Saharan Africa	1.3	1.0	0.6	-3.0	-3.4
EEC	0.3	0.2	0.3	-0.3	1.0
Other Western Europe	0.1	0.1	0.1	.0	.0
USSR	3.0	3.3	4.3	1.1	2.0
Eastern Europe	0.3	0.2	0.3	-1.1	1.3
South Asia	4.5	5.0	6.1	0.9	1.6
East Asia	0.8	0.7	0.9	-1.0	2.1
Asian Centrally Planned	2.8	4.2	5.3	4.2	1.8
Oceania	0.8	0.8	0.8	.0	.0
Latin America	2.1	2.3	2.6	0.8	1.0
North America	2.3	3.1	3.4	3.1	0.8
World	19.7	22.4	26.8	1.3	1.4

Source: Historical data from FAO.

IMPLIED WORLD TRADE

World food production and consumption continued to grow rapidly in the 1970s, but at a rate somewhat slowed from that of the 1960s—reflecting the overall slower population and real income growth. The decade was generally characterized by a slowing of demand growth in the developed countries where population growth slowed. In the developing countries, however, demand accelerated as the rising incomes in some generated demand for grains and meat, and technological adoption in the lower-income countries resulted in expanded production. Growth was also rapid in the centrally planned economies where emphasis was on increased livestock production.

Global trade in food commodities expanded rapidly in the 1970s, becoming an increasingly important aspect of the world food system. The value of all food exports in 1980 was 4.4 times the value in 1969-71, and the volume was 1.5 times greater. Grain trade alone grew more than three times as fast as production. At the beginning of the decade, an average of 66 mmt of grains entered the world market; by the end this had almost doubled to 131 mmt. Nevertheless, trade in food is still only a small proportion of global production—8.3% for grains. This, of course, means that relatively small changes in production and consumption can have large short-term impacts on the volume and prices of food commodities traded in the world market.

Global Balance

Meat

Overall, per-capita meat consumption for the world grew 1.3% annually in the 1970s, enabling an average increase of 3.5 kg per person. However, the differences in changes among the regions were pronounced. Consumption actually declined in Sub-Saharan Africa, while it grew rapidly in the developed and centrally planned countries.

Gains in per-capita consumption are projected to slow in eight of the twelve regions—the exceptions being East Asia, South Asia, North Africa/Middle East, and Latin America where the rising incomes will enable considerable growth to occur. With slower growth elsewhere, the average growth for the world is projected to be 0.7% annually to 1993.

By far most livestock products are consumed where produced. World trade is consequently small (only 2% of the meat consumption and 3.4% of milk consumption in 1978-80). The growth in trade in the 1970s was relatively slow, averaging 2.4% annually. It is projected to increase much more rapidly in the next 10 years—from 2.6 mmt of imports to 5.2 mmt, an annual growth rate of 5.1%. The major growth in imports will occur in North Africa/Middle East, East Asia, and Latin America, while export growth will occur in the EEC (shifting from a net importer to a net exporter), Eastern Europe, and Oceania (Table 15). The USSR and the United States are expected to remain net importers, although at smaller volumes than in 1978-80.

TABLE 15
Historical and Projected Meat Trade

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—thousand metric tons—			—percent—	
North Africa/Middle East	-94	-733	-2,497	25.6	9.1
Sub-Saharan Africa	54	-7	-41	1.4	13.5
EEC	-1,095	-407	725	10.4	7.6
Other Western Europe	-152	-155	-210	0.2	2.2
USSR	-76	-456	-372	22.0	1.4
Eastern Europe	111	560	940	19.7	3.8
South Asia	2	29	44	34.6	3.0
East Asia	-335	-784	-1,179	9.9	3.0
Asian Centrally Planned	117	188	280	5.4	2.9
Oceania	1,129	1,614	3,245	4.1	5.1
Latin America	747	460	-892	5.2	8.0
North America	-356	-57	-43	18.4	2.0

(-) = Imports.
(+) = Exports.

Milk

As with meat, the world trade in dairy products (expressed in milk equivalents) is relatively small but growing. It increased in the 1970s at an average annual rate of 6.4%, reaching 15.8 mmt net imports at the end of the decade (Table 16). The prevailing pattern of the 1970s is not projected to change appreciably by 1993. The major growth markets will continue to be North Africa/Middle East, Latin America, and East Asia, while imports will decline in the USSR and grow only slowly in the other deficit regions. Overall, trade is expected to grow at 2.7% annually—less than one-half the rate of the 1970s.

Grains

Overall, global grains production in the 1970s grew at an average annual rate of 2.6% while consumption grew at 2.7%. Stocks were drawn down and not rebuilt until the early 1980s. In contrast to the 1960s, the 1970s were generally characterized by more volatile prices and relatively lower levels of stockholdings. Global production fell twice in the 1970s—2.9% in 1972 and 2.6% in 1979—and the supply-demand balance was generally tighter throughout. The pattern of stockholdings also changed somewhat. As the traditional exporters sought to avoid the surplus situation of the 1960s, they held a reduced proportion of the world stocks while some importing countries held a larger share than previously.

Through the remainder of the decade and to 1993, world production and consumption of grains are projected to grow more slowly than in the 1970s—at an annual average rate of 1.9%. This reflects the projected continued slowing in the global population growth rate and slower rates of economic growth than in the 1970s. Nevertheless, grain consumption will reach 2,039 mmt—471 mmt more than in 1978-80 and an increase over one-third larger than the entire North American production. While the absolute amount of growth is large, it does not portend a significant increase in per-capita availability—only 8.0 kg more per person—a rate of growth of only 0.2% per year. This is considerably slower than the 0.8% in the 1970s.

When the world grain economy is viewed without including the traditionally surplus-producing regions of North America and Oceania, and more recently the EEC, a striking picture emerges. Production for the rest of the world grew 2.4% annually in the 1970s, while consumption grew much more rapidly at 3.4% (Table 17). The deficit at the beginning of the decade was 40 mmt, an amount equal to 4.3% of consumption. It had grown to 133 mmt by 1979-81—10.7% of consumption. In the decade ahead, production is projected to grow 1.99% annually while consumption grows at 2.09%, producing a deficit by 1993 of 224 mmt or 13.6% of consumption.

TABLE 16
Historical and Projected Milk Trade

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	-1.9	-6.3	-9.8	14.3	3.2
Sub-Saharan Africa	-0.3	-0.7	-1.0	8.5	2.4
EEC	-3.3	8.0	14.7	14.7	4.5
Other Western Europe	0.7	1.0	0.9	2.8	.0
USSR	1.2	-3.0	-2.8	13.0	0.6
Eastern Europe	-1.0	-0.1	0.1	20.9	.0
South Asia	-0.1	-0.5	-0.6	25.3	1.4
East Asia	-1.0	-1.7	-2.6	6.0	2.9
Asian Centrally Planned	.0	-0.2	-0.5	29.2	5.8
Oceania	7.2	5.9	7.4	2.3	1.7
Latin America	-1.3	-2.1	-4.7	5.7	6.1
North America	-0.2	-1.1	-1.1	23.4	.0

(-) = Imports.
(+) = Exports.

TABLE 17
Grains: World Less North America, Oceania, and the EEC

Item	1969-71		1979-81		1993
	mmt	percent	mmt	percent	mmt
Production	874.8		1,103.6		1,426.7
Average Growth Rate		2.35		1.99	
Consumption	914.5		1,236.4†		1,650.9
Average Growth Rate		3.41		2.09	
Deficit	39.7		132.8		224.2
As % of Consumption	4.3		10.7		13.6

† 1978-80.

This view illustrates the growing dependency on a few grain surplus-producing regions. In 1969-71, four regions were net exporters. But over the course of the decade two of those, the USSR and Latin America, became net importers (Table 18). At the end of the decade, only North America and Oceania remained net exporters, with the former accounting for 90% of the net exports. But by 1993, these regions will be joined by the EEC.

The pattern of world grain trade is projected to change but little by 1993. The EEC with the high-production incentives under the Common Agricultural Policy is expected to become a net exporter. But dependence of the rest of the world on the traditional exporting regions will become even stronger (Figure 13). Of the 224 mmt of exports projected, 84% will come from North America, 10% from Oceania, and 6% from the EEC.

The imports by the deficit nations will continue to grow, but at slower rates than in the 1970s with one exception—South Asia—where the demand for livestock products in the middle-income countries will cause grain use to outpace domestic production. The USSR will continue to be a major importer but with growth at 3% annually—much slower than in the 1970s. East Asia will be the largest importing region, but with growth at only one-half of the rate of the 1970s.

Oilseeds

The 1970s were also characterized by rapid growth in world oilseed production, consumption, and trade due to the growing demand for both edible oils and oilmeals for livestock rations. Production expanded from 108 mmt to 163 mmt, an average growth rate of 4.3%. It is projected to reach 213 mmt by 1993, a 2.0% annual growth. Per-capita consumption will increase 3.0 kg, a growth rate of 0.6% annually compared with 2% in the 1970s.

A larger proportion of the annual oilseed consumption is traded in the world markets than grains—about 33% in 1978-80. The growth in trade will continue to follow the pattern of the 1970s, with the fastest increase in North Africa/Middle East but on a relatively small volume (Table 19). The EEC remains the largest importing region, accounting for 52% of the total. As with grains, two regions supply the bulk—Latin America and North America (primarily Brazil and the United States).

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FIGURE 13

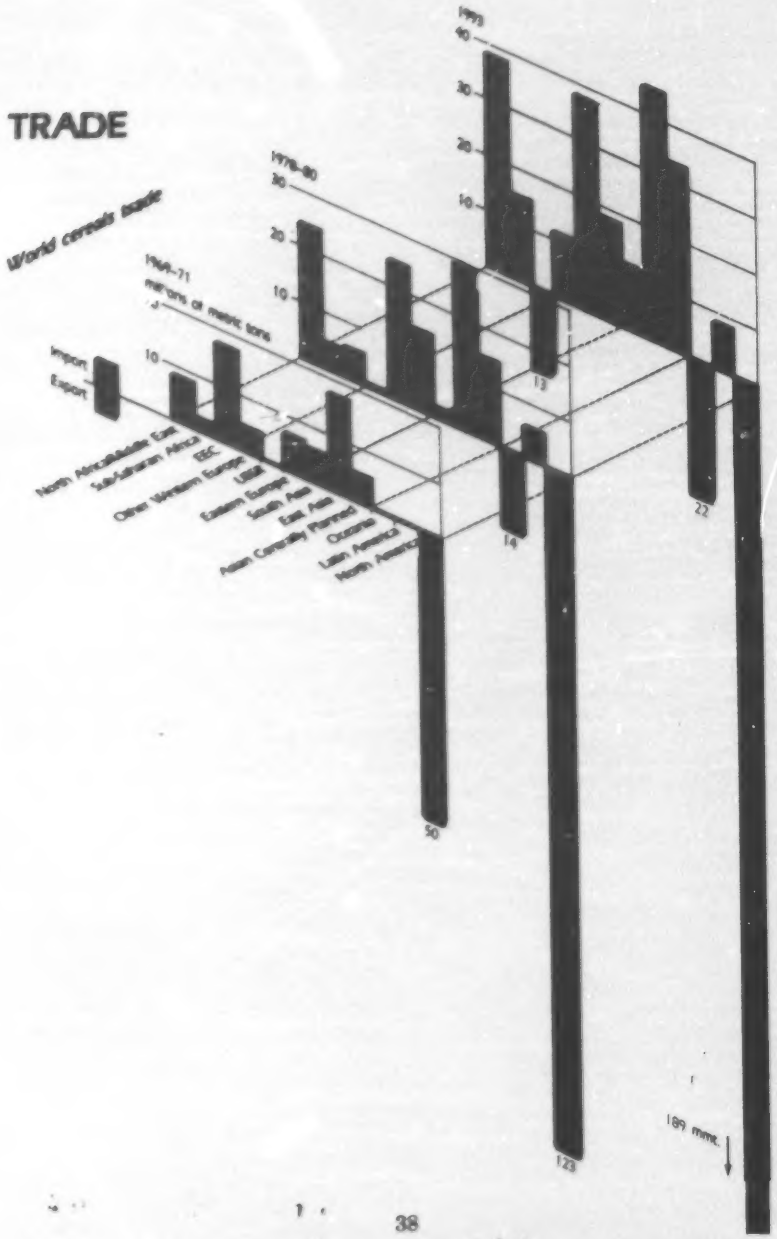

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TABLE 18
Historical and Projected Cereals Trade

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	-7.8	-24.1	-38.9	13.3	3.5
Sub-Saharan Africa	-1.8	-4.4	-17.5	10.7	10.4
EEC	-17.3	-1.2	12.6	25.8	19.2
Other Western Europe	-4.5	-9.7	-11.2	8.9	1.1
USSR	5.3	-24.6	-37.3	21.2	3.0
Eastern Europe	-6.6	-14.2	-19.2	8.9	2.1
South Asia	-5.8	-2.1	-11.4	10.7	13.0
East Asia	-17.1	-29.8	-46.9	6.4	3.3
Asian Centrally Planned	-5.1	-15.0	-33.4	12.7	5.9
Oceania	8.6	14.0	22.5	5.6	3.4
Latin America	3.6	-5.8	-8.6	11.2	2.8
North America	50.1	122.9	189.3	10.5	3.1

TABLE 19
Historical and Projected Oilseeds Trade

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	-0.1	-1.4	-3.7	32.5	7.3
Sub-Saharan Africa	3.2	2.2	-0.4	4.0	1.2
EEC	-17.0	-30.4	-35.0	6.6	1.0
Other Western Europe	-2.6	-5.1	-6.8	7.6	2.2
USSR	-0.7	.0	-0.2	—	—
Eastern Europe	-2.8	-6.9	-8.3	10.5	1.3
South Asia	2.2	2.7	2.2	2.2	1.5
East Asia	-3.2	-5.9	-11.4	7.2	4.9
Asian Centrally Planned	.0	-1.1	1.1	—	.0
Oceania	.0	0.1	-0.9	—	23.4
Latin America	2.9	15.2	18.4	20.1	1.3
North America	16.6	34.2	45.1	8.4	2.0

(-) = Imports.
(+) = Exports.

Fibers

World trade in fibers was largely dominated by the developing regions in the 1970s. Only five of the twelve regions were net importers during 1978-80; all are expected to continue to import into the 1990s and be joined by Sub-Saharan Africa (Table 20). Growth in consumption of natural fibers is expected to continue during the next 10 years with less intense competition from synthetic fibers. Only in East Asia are imports expected to increase significantly. Exports from the USSR and North America will grow considerably, while exports from Latin America will decline.

TABLE 20
Historical and Projected Fibers Trade

Region	1969-71	1978-80	1993	Annual Average Change	
				1969-71 to 1978-80	1978-80 to 1993
	—million metric tons—			—percent—	
North Africa/Middle East	0.8	0.5	0.6	5.0	1.8
Sub-Saharan Africa	0.9	0.5	-0.1	5.3	0.7
EEC	-1.6	-1.0	-0.9	5.0	0.8
Other Western Europe	-0.4	-0.4	-0.3	1.4	0.4
USSR	0.3	0.7	1.1	10.4	2.9
Eastern Europe	-0.7	-0.9	-0.9	1.8	0.5
South Asia	0.5	0.5	0.5	1.4	.0
East Asia	-1.0	-1.6	-2.1	5.3	2.1
Asian Centrally Planned	-0.3	-0.9	-1.0	13.5	1.1
Oceania	0.1	0.2	0.3	10.5	3.8
Latin America	1.1	1.0	0.9	1.0	0.7
North America	0.5	1.5	2.0	12.5	2.4

(-) = Imports.
(+) = Exports.

IMPLICATIONS

One overall conclusion from this study is that the world will be able to feed its much larger population in 1993 marginally better than at the end of the 1970s. However, there are unsettling conclusions as well. Large numbers of people will continue with only barely adequate or inadequate diets, and several projected improvements hang on economic trends that are highly vulnerable to reverses. The projections presented here would suggest the world food system of the early 1990s might be characterized as follows:

- The growth of the world food demand will slow considerably from the rate of the 1970s. Growth will be slowest in the developed countries and most rapid in the higher-income developing and centrally planned countries. Per-capita meat, grain, and oilseed consumption will increase by small but significant amounts, while milk and fiber consumption will continue to decline—again by small amounts.
- Two regions are social and economic time bombs. In Sub-Saharan Africa, the rapid population growth coupled with slow income growth implies declining food consumption and widespread starvation. Latin America faces brighter prospects, but extreme economic risks. The region, while rich in natural resources, is capital-short and heavily in debt. The prospects are for moderate growth in food consumption, but the chance of economic stagnation is very great.
- The world's resources (both technical and physical) are expected to be sufficient to enable production to expand to meet growing demand. For the world as a whole, the availability of land for agriculture is not expected to constrain food production growth. The major source of greater food availability over the last 30 years has been improved yields, and this is not expected to change in the next decade. For example, the projections suggest that 84% of the 446 mmt global increase in grains output will be from higher yields, with the remaining 16% coming from expansion of cultivated area.
- Greater volumes of trade will be necessary if the world is going to be able to feed its larger population. The absolute volume of food traded will be significantly greater than in the 1970s. However, the rate at which trade expansion occurs will be slower. Trade in grains is projected to grow 3.9%, less than one-half as fast as in the 1970s. Meat trade will grow much faster, while dairy products, oilseeds, and fibers trade will slow.
- The pattern of projected trade indicates there will be a further concentration of exports among the few grain-surplus regions, reflecting the growing gap between production and consumption in the rest of the world. As the gap grows, stockholdings and trade assume more importance in stabilizing annual production-consumption fluctuations. Such fluctuations in particular years can be expected to result in sharp changes in food prices and to make the volume of trade more erratic from year to year.
- The world food-market environment can be expected to become more competitive. Major food exporters will be competing more intensely

for the available markets. Year-to-year production adjustments will be required if significant shifts in real prices are to be avoided. Trade disputes can be expected to intensify in years when favorable weather results in large harvests and abundant supplies.

- Food deficits will intensify in every region but three, but generally can be overcome by greater trade. Most regions likely will have the financial resources to support the trade needed to meet at least minimal requirements. Sub-Saharan Africa's special problems arise from rapid population growth and political instability. It is the only region where population growth will continue to accelerate rather than slow. Imports by 1993 will be large. But even when added to domestic production, supplies will not be sufficient to increase per-capita consumption. Food aid will be required there in large amounts, especially in years when production falls below trend.
- While this study neither explicitly measured prices nor attempted to project them, the results suggest that the postwar trend of declining real prices of food commodities could reverse and begin a slow upward movement.

The findings summarized here have broad implications for strategists and planners in business and finance, government, international trade, food and development assistance, technology development and transfer, as well as agricultural production. In the discussion that follows, some of these implications are suggested by broad categories. An outline of implications for the United States concludes the summary.

Policy

Governments of all types commonly intervene in their food and agriculture sectors because of the fundamental importance of production and distribution of food for stable societies. As agriculture has become more industrialized and as trade has grown in proportion to world food consumption, the importance of governmental actions has become much greater. Today, food and agriculture are affected as much by macroeconomic, trade, and development policies as by policies directed specifically to food and agriculture.

Macroeconomic Policies

The impact of macroeconomic policies on food consumption is direct: only with rapid economic growth can growth in consumption and improved nutrition be supported.

In general, trade in agricultural products has been rising faster than growth in consumption, and is especially sensitive to changes in economic growth. Surges in consumption mean sudden increases in trade; conversely, consumption declines imply trade contractions. The consequent impacts on production are large, if indirect and lagged. Rapid growth leads to an acceleration in production; slow growth often results in the need to adjust resource use, especially in exporting countries. Economic prosperity makes financing food and agricultural policies much easier. It is in times of contraction when the cost of these policies rises and when budget pressures are the greatest.

Over the 1970s, the world economy was heavily stimulated by fiscal and monetary policies. Inflation became a serious problem, and in many countries debt rose rapidly and could only be serviced with continued economic

expansion. The economic retrenchment of the early 1980s reduced capital flows and export earnings and created a financial crisis in parts of the developing world. Overall, the result of the recession was a sharp reduction in food and fiber consumption and trade. Production responded slowly; supplies soon became excessive, and export prices fell sharply. Exporters were hurt, especially those who export for a major share of their foreign exchange earnings. Importers received a temporary windfall. But those servicing debt and paying for imports in dollars were hard-pressed.

More rapid real economic growth will make the developing-country debt problem easier to resolve, but obtaining an acceptable balance between the debt-service ability and investment needs will be an enduring concern. It will be especially difficult for those countries who rely on tropical product exports for most of their foreign exchange earnings, because the growth in trade for these products will be substantially slower than for other agricultural products.

Food and Agriculture

The role of governments in food and agriculture became much clearer in the 1970s as two major policy developments became the focus of worldwide attention. While governments can reduce the shocks of food price changes, most cannot afford to price large groups of foods far below their cost. Artificially low food costs heavily stimulate consumption, especially when incomes are rising. When food prices are not directly related to producer prices, consumption is encouraged with no comparable stimulus for production. As a result, these policies have become too costly to be sustained, especially in cases where the subsidies came from borrowed funds.

The centrally planned economies and many developing countries have long attempted to maintain stable and low food prices, while few have had policies of relatively high producer prices. Most industrial countries have had complex structures of producer price incentives, and some, notably the EEC, have also held consumer prices relatively high. Both types of structures have proved increasingly to be costly, cumbersome systems that are in the process of change.

The consequences have depended on the policy structure. Where food prices and producer prices have been held low, consumption has tended to outpace production, and costly commodity imports were required. Where food prices were kept low and producer prices relatively high, consumption and production increased, but the subsidy became an increasing budget burden. In developed countries where producer incentives have been held very high, and especially where consumer prices were high as well, production has far outpaced consumption and surplus disposal has become extremely expensive.

In the centrally planned regions, where administrative control is more pervasive, low and stable consumer prices for basic foods have been important objectives. Not only are consumer prices lower than producer prices, but the differential has become very large. The cost of this annual subsidy in the USSR alone is about $70 billion. Recently, food prices have been increased relative to producer prices in several Eastern European countries—a consequence of their financial crises. These shifts have been very painful politically, but are essential to avoid further financial difficulties. Consumer prices likely will remain below producer prices in these regions,

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especially in the USSR, although attempts will be made to slow the growth in the subsidy over the coming decade.

The implications of this trend are as important for the developing countries as for the centrally planned economies. In general, they mean that developing countries will be unable to use stable and highly subsidized food prices to help their poor, and they certainly will not be able to borrow to do so. It means increased pressure on developing nations to formulate investment and employment policies to help the world's poor.

The four highly developed market economy regions—North America, the EEC, Other Western Europe, and Oceania—accounted for about one-third of world production during 1969-71, but for 54% of imports and 63% of exports of agricultural products. The private sector is dominant in these regions, but their governments' policies are fundamentally important to the performance of the world food and fiber system. The fiscal, monetary, financial, food, agriculture, and trade policies of these regions have a major impact on world consumption, trade, and production.

In response to the high grain prices in the early 1970s, grain production in these regions increased sharply. Each developed systems of economic incentives to promote food production. Large sums are spent annually to increase productivity and to protect producers, but direct input price subsidies are less frequent. Most provide tax concessions to producers, and concessional credit to others. Prices are supported for most crops and dairy products, and some support meat and egg prices or returns. The level of market price support varies widely, being highest in the EEC and lowest in Oceania. Export markets are promoted, and below-cost sales are made on world markets when surpluses accumulate. The results have been huge increases in production and immensely costly programs in both North America and the EEC.

The EEC's Common Agricultural Policy incorporates relatively high and stable internal prices that at times contribute to instability in world markets. Producer and consumer decisions are guided mainly by the administered prices rather than by market force, in much the same manner as in the centrally planned economies. Excesses are put on world markets at far below internal prices. While the degree of governmental intervention is very high in the EEC, it varies depending on the supply-demand situation in Other Western Europe, North America, and Oceania—increasing when supplies are either excessive or very tight. The cost of the food and agricultural policies, especially in North America and the EEC, has become nearly overwhelming during the current period of excessive supplies.

The implications for change in these policies are twofold: first, the power of economic incentives. The sharp increases in world production are nearly perfectly correlated with patterns of incentives. The implication for both centrally planned and developing countries, where production is lagging behind policy objectives, is clear.

Second, these trends portend a rationalization of the price and incentive policies in these regions. In spite of the fact that strong production incentives inevitably develop a political momentum that is difficult to counter, the very large costs of incentive structures unrelated to domestic or world markets is difficult to justify and likely to become intolerable over the longer run. The implications of this rationalization are not now well understood, either for the countries themselves or the global food system, and need more scrutiny.

Of the developed regions, the USSR has had the greatest difficulty in maintaining and increasing food production during the 1970s. While there were large gains in total and per-capita production in Eastern Europe and the ACP during the 1970s, the USSR experienced only slow growth. A common pattern of gradually relaxed agricultural constraints has developed, with increased emphasis on individual incentives, private plots, and market prices. The positive experience of Hungary in this regard has been observed with keen interest in the USSR and the other Eastern European countries. Similarly, the apparent success of recent policy modifications in China has also stimulated interest in expanding private enterprise and free markets.

In addition, the USSR is experimenting with relaxing constraints on the agricultural system and may make this more widespread in the future. China is also expected to move toward a less rigid planning system and to rely more on individual incentives and markets to encourage desired shifts in production. Such changes, should they occur, imply increases in both production and consumption in the centrally planned economies, including the USSR.

With its low and stable food prices and slow growth in production, the USSR's net imports climbed sharply during the 1970s. Despite solid gains in per-capita production in Eastern Europe and the ACP, their net imports also continued to rise. These regions are a large enough force in world markets to influence the price of the products they import. Policies that rationalize their production and consumption on the basis of real costs would remove a major source of instability from world markets.

Because the United States has the capacity to provide a major and growing share of the world's food needs at very low cost, it has become heavily export-oriented in its commodity policy. Growing world demand for food means that orientation likely will continue, but experiences over the last decade have raised a number of profound issues.

While U.S. policy is well designed to expand to meet world market needs in the short run, it is no longer able to efficiently adjust to reductions in markets. Because these trends shift quickly and dramatically, such adjustments can be extremely costly and painful. The need for a mechanism that adjusts domestic production quickly and equitably, with much of the cost borne by producers, is dramatized by the high cost and lack of effect of current programs. In addition, a need for equitable adjustments in the international market is growing. This can be brought about by confrontations, as in the case of the current U.S.-EEC trade dispute, or by a more orderly series of policy agreements. In the absence of agreements, confrontations are inevitable.

The successful export policy orientation also depends increasingly upon long-term research, development, and other inputs into agricultural production. The dependence on yield increases rather than area increases will grow sharply over the decade, more in the importing than exporting regions. Nevertheless, the long lags between investment and payoff and the heavy dependence on the complicated system of research, development, adoption, and practice mean that not only must the developed nations maintain their investment in research and development, but they must also help other less-developed nations maintain and increase theirs as well.

Finally, the export policies of the developed world depend not only on the technology that comes from improved seeds, practices, fertilizers, pesti-

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cides, and machinery, but also from conservation and improvement of soil resources. Soils can be irretrievably damaged by intense cropping if they are particularly vulnerable, or if insufficient effort is made to protect them. Soil conservation programs and policies in the past have not been designed to adequately serve the often-conflicting objectives of conservation, production adjustment, and fiscal austerity which will be required in the future if the resource base is to be maintained. The challenge is to effectively implement equitable policies in the developed countries, and to help the developing nations avoid lasting damage to their scarce soil resources.

Trade

Trends in world trade in the next decade will be dominated by three characteristics: the growing magnitude of trade, the increasing dependence of the world's poorest regions on trade to improve diets of their rapidly growing populations, and the increasing importance of a small number of developed nations as the chief source of trade in primary food commodities.

The growing importance of trade will increase pressures for a less-protective trade environment. Nevertheless, in periods of surplus commodity supplies, as is the case in 1983, competition among exporters is intense and producers can be expected to call for protection, especially from subsidized exports. The study indicates that such periods are unlikely to dominate the decade, and persistent surpluses like those in the 1950s and 1960s are not expected. As demand exceeds production in the importing regions and producer prices trend slowly upward, consumers there will have strong grounds to oppose trade restrictions and exporters little reason to propose them. Nevertheless, trade access issues are extremely sensitive, and efforts to defend and expand restrictions already in place could prove formidable. Exporters of both agricultural and nonagricultural products who find their markets limited are likely to be the most practical advocates of trade liberalization.

An additional question of fundamental importance concerns the ability of importers to pay for food commodities they need, and the political difficulty in developing nations of increasing food purchases from industrialized exporters. The expected increase in imports by developing nations is large—large enough to reduce the EEC, the world's largest importer of four basic agricultural products in 1980, from first to third behind North Africa/Middle East and East Asia, by 1993. It is in the developing regions, where population growth is rapid and where consumption response to income increases is great, that import growth will be most important.

Sub-Saharan Africa will have the greatest proportional increase in imports. While that import level is essential to human nutrition in the region, it could be an immense economic burden. Whether the region can sustain the essential trade without very large amounts of outside assistance, perhaps on the order of $1 billion annually in 1980 dollars, will be a very important issue through the decade.

The high level of basic commodity trade could also be a burden on the economy of North Africa/Middle East. But even though the projected increase is large, it does not imply a greater share of GNP spent for imports.

The same issue could be important in the Asian Centrally Planned Economies and Latin America, since both likely will spend a higher share

of GNP for basic commodities, although the increase is small for the ACP. For Latin America, the more-than-threefold increase could place greater pressure on import policies.

The growth in trade in basic foodstuffs is likely to cause broader concerns about the increasing dependence on such a small number of exporters. While trade will occur among most regions, net exports will come from the two traditional exporting regions, North America and Oceania, and the EEC, a region that has switched from a net importer of meat and cereals to an exporter. Growing dependence on food imports from developed nations is likely to be unpopular regardless of the economic advantage it brings, and could heighten North-South tensions at times.

This situation is also likely to heighten interest at times in export cartels, especially as the number of exporters declines and the number of importers grows. Interest will center around efforts to share stockholding burdens now left almost entirely to exporters, and production and consumption adjustments in atypical times.

Economic Stability

During much of the 1950s and 1960s, the world agricultural economy was characterized by relative stability. World trade was still small, and several major countries and regions remained isolated from world markets. In the United States, that period was characterized by overly abundant supplies, low prices, burdensome stocks, substantial cropland idled by government programs, and relatively small volumes of agricultural trade.

Several forces, long in the building, converged in the early 1970s to fundamentally change this situation. The 1970s were characterized by instability—volatile prices, trade disruptions, fluctuating stocks, and significantly changed trade patterns. The findings of this study suggest the potential for instability similar to that of the 1970s to characterize agriculture into the 1990s.

Instability arises from efforts to maintain or increase consumption in the face of production shortfalls and inadequate stocks. As consumption requirements (especially for grain) more and more outpace production and dependence on the surplus regions increases, commodity prices and trade volumes will become increasingly sensitive to year-to-year changes in production or consumption, or both. Even a few consecutive years of favorable weather and abundant harvest worldwide dampen trade requirements and force production adjustments in the exporting regions (amply illustrated by 1981-1983). Conversely, adverse weather and production shortfalls in either deficit or surplus regions draw down stocks rapidly, tighten the supply-demand balance, and result in volatile prices.

These periods will raise serious issues about stockholdings and reserves, including the equitable sharing of the burdens of holding reserves by the deficit regions. Questions will also be raised about production adjustment, a necessary action in the years when supplies are abundant and prices low, especially in the surplus regions. The evidence suggests that most of the production adjustments required in the 1970s were made by the United States—through idling cropland acres and holding stocks in a formal reserve—as was part of the consumption adjustment (especially through livestock feeding).

Another implication of the instability relates to the trade environment. The periods of abundance would suggest that competition among the exporting nations for the available markets will be intense. This will undoubtedly lead to periods of heightened tensions and greater use of subsidies and other mechanisms to capture and retain markets. In the converse situation, trade controls and restrictions, use of bilateral arrangements and questions of reliable supply will emerge.

The wide swings in supplies and prices that are increasingly likely also will highlight need, extreme in some years, for food assistance, not only for localized calamities but also on a much larger scale in those regions where purchasing capability is very small.

Research and Development

One of the major projections of this study is that future food output gains will come more from yield increases than from expansion in area. There is still a considerable land area that could be brought under cultivation and considerable rangeland that could be upgraded for livestock production. At the same time, there are growing pressures on the arable land base in some countries (e.g., India, Bangladesh, and Egypt) that will undoubtedly constrain future production advances. On balance, it does not appear that availability of land will pose a serious constraint to expanding production in the next 10 years. Every year, however, the world is relying more on productivity growth for gains in total food output.

Obtaining greater productivity on the land requires investment in research, development, and dissemination of new technology. There is a substantial time lag (variously estimated to be from 10 to 20 years) between commitment of funds to technological research and development and results that follow widespread adoption. Much of the increase that will be seen in the next 10 years will be the result of commitments made 10 to 20 years ago.

There is substantial potential for increasing production in most developing countries by increasing yields on the existing land. Judging from the current disparity of yields between developed and developing countries, investment in research in the latter countries would bring high payoffs. Research investment, coupled with aggressive extension efforts, could greatly increase the output in many countries. In many parts of the world, both area expansion and technological advancement will be absolutely essential if any improvements in quantity and quality of diets and standards of living are to be realized.

Sub-Saharan Africa is a most obvious example: production per capita is actually declining, and the vast majority of the countries of the region do not have the purchasing power to augment domestic supplies sufficiently to meet essential requirements. Moreover, they lack the capital to make any significant investment in development of the agricultural sector or to undertake substantial research and development programs. Extensive external assistance appears the only hope for any improvement in the situation.

Greater output in much of the developing world will depend on accelerated development of the agricultural sector, an achievement requiring large capital investment, much of it foreign and much of it private. It is unlikely that the assistance efforts of developed-country governments will involve anything remotely approaching the amounts of capital required in

most countries. Private-sector investment in the agricultural sector must be encouraged. Yet, policies pursued by many developing countries not only have not emphasized agricultural development (many have actually constrained production) but they certainly have not created an environment conducive to growth and development of a viable private sector. Policy changes that create an attractive investment climate and encourage economic activity will be prerequisites to development in many of these countries.

Nutrition

The results of the study present mixed implications for the nutritional status of the world's people. Projected per-capita increases in food consumption, although slight in most cases, suggest that a much larger world population in 1993 will be better off than was the case in 1980. While this is a positive development, another view is that a vast proportion of the world's people, those in the poorer nations, will still be very poorly nourished, while the portion that will be well-fed will be relatively much smaller. There will be little or no improvement in reducing the proportion of the global population that is malnourished—the link between poverty and inadequate diets continues to dominate the world food situation.

These results imply a growing danger of starvation and need for food assistance in some regions—generally those where consumption is most rapidly outpacing the growth of production. Again, Sub-Saharan Africa will likely experience the most difficulty. The consumption projections for that region are based on an annual average GNP growth of 2.7%. That rate, however, becomes a negative average 0.5% on a per-capita basis when the rapid population growth is taken into account, implying declining real incomes. The implied deficit in grain availability is 17.5 mmt, an amount thought to be obtainable with the region's purchasing power but not enough even to maintain current diets. Substantial quantities of food assistance are expected to be required just to maintain per-capita consumption levels. Moreover, any production shortfall will clearly create emergency conditions and require massive amounts of aid to overcome.

Financial Environment

The economic developments of the 1970s and early 1980s have emphasized the interrelationship among the world's regions, and particularly between developed and developing nations. The world's growth markets for food commodities are the lower- and middle-income regions where population is growing, where large shares of income growth are used for food, and where food demand is outpacing production. Slower demand growth in developed regions means increasing export availability and increasing exports from those sources.

Real growth in food demand in developing regions depends primarily on economic growth, and that depends heavily on the health of the international economy. Slack demand in developed-country markets causes low prices for many of the products developing countries sell. Because of inexorable pressure from population growth, and the need for growing investment and jobs, for stable food production incentives in real terms, but for minimal increases in food costs for the poor, many developing countries are forced to depend heavily on external development capital. The macroeconomic policies in the industrial countries are the major determinants of the

availability and cost of that capital.

Five of the twelve regions have GNP per capita of less than $2,000. Four of the five have population growth rates greater than 2.1%, with ACP the exception. Furthermore, the growth of external debt in developing nations during the 1970s was dramatic—from $77.9 billion in 1971 to $426.1 billion in 1980—while interest costs increased from $3.1 billion to $34.1 billion. By 1980, 63% of the external debt and 71% of the interest was accounted for by just 13 nations, with the three largest Latin economies—Brazil, Mexico, and Argentina—prominently included.

The implications of this interdependence for world food trade are immense. While not all industrialized regions are exporters, all developing regions are increasingly dependent importers of basic food commodities. For example, imports by the five poorest regions will account for 49% of the cereal trade in 1993—up from 39% in 1980. This pattern of trade raises several important issues for the decade:

- Efforts to expand investment in developing nations will be controversial. The extent to which investment capital is available either on concessional or market terms will determine their economic growth. The terms at which this capital is available and the cost of its service will have significant impacts on the demand for commodities.
- The requirement that oil be purchased in hard currencies is likely to place increasing strains on non-oil exporters to minimize hard-currency imports and maximize exports. Even with only slow increases in petroleum prices, domestic inflation in developing countries—together with low export prices—places extreme pressure on the trade balance in these countries. Efforts to avoid this conflict could lead to increasing barter and soft-currency trade, already a major factor in many world markets, and to increases in nonconcessional sales by trading companies formed for that purpose. The extent to which the world monetary system can accommodate the growth in trade, and the character of the extraordinary exchange systems that arise to help relieve those pressures, likely will be growing issues over the decades.

Implications for the United States

In essentially every respect, the United States is one of the world's few fortunate nations. Population growth is slow, and per-capita income is very high. Food consumption is very high for most consumers, and programs to improve nutrition for the poor are very large. Our natural resources are abundant and of high quality, and have been made highly productive through investments in a comprehensive research system. We are able to produce much more than needed domestically, and have a highly positive balance in the agricultural trade account. The markets for the major export products are expanding much faster than is demand for imported products. We have been able to afford large expenditures to protect producers from natural or economic disasters, and for foreign food and agricultural development assistance.

A consequence of our favorable position is the distance, wide and growing, between us and those much less fortunate. This disparity will be larger a decade from now, and will be a source of increased opportunity, competition, and tension.

Over the coming decade, the entire food and agriculture industry will grow more slowly than during the 1970s. Consumption of food and fiber will rise but much more slowly, and the increase in population will be smaller. We already consume so much food that only a small share of the very large increase in incomes will be spent for food. Per-capita consumption growth will be very small, and those who are involved in the domestic food industry will face all the problems associated with a slower growth market.

Agricultural production will grow faster than domestic consumption, because exports will rise more rapidly. Nevertheless, those who provide services and supplies to the agricultural industry will experience slower growth than during the 1970s.

Exports will rise much faster than domestic use, but again, the growth will be smaller than during the 1970s. Those who are involved in this segment of the agricultural industry also face slower growth even though the expansion will be much more rapid than for those who serve or supply only the domestic segment.

The projections imply a harvested acreage by 1993 about equal to that of 1981, a recent peak. The implication is that our natural resources will be under the same degree of pressure a decade from now as they were in 1981. However, there will be times when substantially less acreage will be harvested, and times when a record acreage will be used. Some land was used too intensively in 1981 and should be removed from intensive crop production. On the other hand, there was some land that was in a less intensive use than optimum.

The growth in exports relative to growth in domestic use will make the deficiency payments to farmers and the acreage control programs ever more controversial. A larger share of the payments will flow to foreign instead of domestic buyers of these products. Our controlling production when supplies are excessive while the other exporters fail to do so will be a growing source of controversy.

The case for a reserves policy will be even stronger in the future, as a larger share of consumption comes from the world market. The year-to-year changes in exports will become larger.

Slower growth in imports of agricultural products—especially sugar, coffee, cocoa, and tea—will add to the problems of the developing-country exporters, and they will become increasingly critical of our domestic and trade policies.

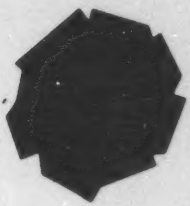
There will be greater need for food and agricultural assistance to the less fortunate countries of the world. The United States will be pressed to provide more technical and financial assistance, either directly or through international organizations. Making China eligible for Public Law 480 would add to these pressures. Yet, the United States appears to be quite reluctant to increase these programs, even though the amounts spent for them are small relative to the amounts spent on the domestic food and fiber industry. For example, $16 billion is spent for domestic food assistance, and only $2 billion for the Public Law 480 program. Yet a substantial share of the latter will be repaid.

The demands on the financial system will also be more pronounced over the coming decade, and more appropriate measures to help those in a crisis will have to be found.

Perhaps the most troublesome finding of the study is the massive increase in the gap between per-capita incomes in the United States (and the

other wealthy countries) and those in the poorest regions. The projections show a larger-than-ever annual increase of $378 per person over the coming decade in North America, only $3.50 a person in South Asia, and a decline of $2.70 a person in Sub-Saharan Africa. Each person's share of gross national product rises to $16,537 in North America and to only $262 in South Asia. This source of international tension, already great, can only be expected to grow in importance over the decade.

Copies of the complete, 600-page report, **World Agriculture: Review and Prospects into the 1990s**, are available at $150 each at the address shown below.



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